METAL INDUSTRY

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Export Trade in 1957

DESPITE the tendency of exports to level off and of imports to fall in the latter part of the year, trade on both sides of the account in 1957 exceeded that in any previous year by a considerable margin. Imports for the first time exceeded £4,000 million, a 5 per cent increase on the figure for 1956. Exports also rose by nearly 5 per cent with an increase of £153 million to £3,325 million. These facts are contained in a review of United Kingdom overseas trade in 1957 and published in the Board of Trade Journal. The overseas trade position in the final month of last year was again very favourable. December figures were in fact almost a replica of those for November. Exports at £282·4 million, were £4½ million lower, but imports also fell by over £6 million to £313·6 million, while re-exports were over £1 million higher at £12·2 million. As far as imports are concerned it is interesting to note in connection with the figures quoted that in non-ferrous metals there were again unusually heavy imports of tin.

Since the second world war, engineering products have played a much more prominent part in our export trade than they did up to 1939. This trend is stated to be still continuing. In 1953 engineering products constituted 37·6 per cent of our exports. By 1957 they formed 40·8 per cent. Metals also are providing an increasing contribution to our exports. Although for a number of years after the war metals were relatively a little less important than pre-war, they now represent about 1 per cent more of our exports than in 1938, having increased their share from 13·2 per cent in 1953 to 14·4 per cent in 1957. In the year 1955 engineering exports increased faster than our exports as a whole, but last year however, there was a marked slowing down in the rate of growth of engineering exports. Metals did better relatively, last year, than in 1956, achieving the biggest rise among the main group of manufactures despite falling prices in the non-ferrous sector.

In 1956 the major part of the rise in exports of metals came from the non-ferrous group, but last year the iron and steel industry took the lead. A continuing improvement in home production of steel, accompanied by some slackening in home demand, enabled increased supplies to go to export trade. The drop in the value of non-ferrous metal exports from their 1956 peak could all be accounted for by the slide in copper prices, which brought down the value of shipments of copper and copper alloys and semi-manufactures by some 12 per cent in spite of an increase of 12 per cent in quantity. Manufactures of metals, other than arms and ammunition, rose at much the same rate as in 1956.

In spite of the many other arguments relating to this country's economic position it is obvious that, in reading this survey, a vital factor in this country's economy must still remain predominantly the continuing pursuit of export trade. That is why industry as a whole should welcome the news that a Canada-United Kingdom Trade Council has been set up to help the sale of British manufactures in Canada. Exports from this country to the Dominion were up by 9½ per cent last year, more than half the rise being in cars, ships and boats. Those who have studied the Canadian market however, are convinced that this trade can well be increased in the future with consequent benefit to the metals industries.

Out of the MELTING POT

Keep in Mind

IF rumour is to be believed, the logical closer linking, if not, perhaps, complete integration, of continuous casting and rolling of non-ferrous metals, and of aluminium in particular, is almost in sight or rather, which is not always the same thing, its attainment is likely to be announced in the near future. Important as such a development undoubtedly would be, it should not be allowed to detract attention, if any, from other possibilities of shorter routes from molten to semi-fabricated metal, notably the route involving atomization followed directly with, if need be, the exclusion of any intermediate contact of the powder with air, by compacting, by extrusion, rolling, or other means. That these are not just theoretical possibilities or patent claims is indicated by developments along not dissimilar lines in the iron and steel industry. One process, for example—the Stora Powder Steel process—developed in Sweden, has carried matters even a little further by incorporating the final stage of the production of the steel powder into the process. It starts with a mixture of granulated pig iron and iron oxide (iron ore concentrate or mill scale) which is placed in a flat, rectangular steel sheet box (typical dimensions: length 1,000 mm., width 250 mm., depth 60 mm., thickness of sheet 1 mm.) to which a cover plate is then welded. The box is passed through a roller hearth furnace, in which it is heated to 1,100°C., at which temperature the granulated pig iron is decarburized by the iron oxide to steel. On emerging from the furnace, the box, which now contains steel powder, enters a rolling mill on its first stage of conversion into sheet and strip. Some of the output (about six per cent) is returned to the process for making more boxes. Instead of individual boxes, the possibility has been envisaged of using a continuous "box" formed from strip, with upturned edges, and providing a cover strip moving at the same speed as the "box" and being continuously welded to the latter along the edges. The continuous box could be cut up into suitable lengths for more convenient independent operation of the rolling mill.

Mechanism

SUCCESS of moving-conveyor mass production lines and, more recently, of the automatic transfer and of more or less automated lines, is undoubtedly at the bottom of the widespread trend towards approaching widely diverse and quite unrelated problems and situations along analogous lines. If in doubt, mechanize, seems to be the most usual precept. The result is an ever-present strong temptation, even when things are running quite well, to imagine that they would run very much better if some degree of organization, a flow chart or two, a system or two, time-keeping, forms, etc.—in other words, a lesser or greater degree of mechanization in the widest sense of this term—is introduced. While there certainly is some justification for this point of view, it does overlook the risk of mechanization outgrowing whatever it is that is being mechanized, to the ultimate detriment of the latter. Much the same considerations apply to the closely related procedure of providing the mechanism or mechanization—again in the broadest sense of these terms—in advance, and in the expectation of performances and results to follow. Thoughts of the above kind arise, for example, on learning that representatives of ten countries meeting in Chicago at the recent World Metallurgical Congress, approved the proposal for the formation of a "Free World Metal Science Brainpower Pool" and established a working basis for the faster exchange of scientific data in the metals field. Membership in the "pool" will be comprised of the leaders of some twenty scientific metal societies. Each society is to appoint a committee of correspondents who will relay pertinent information to the American Society for Metals, which will act as a collection centre, will analyse and interpret the information, and will act as a redistribution agent for all the societies. Requests for special information will be acted upon. Thus, the mechanism appears to be all ready for somebody, figuratively speaking, to press the button and start the clatter of typewriters, the whirr of duplicators, the relaying, analysing, interpreting, redistributing and such-like churning of information, and the filling-up of "In" trays. Since the mechanism does not extend that far, it remains to be hoped that information will, indeed, be forthcoming at one end, and will be found useful and actually used at the other.

The Lot

A DIFFICULTY encountered when using aluminium wire instead of copper wire in electrical apparatus is that of making connections by soldering in a simple and reliable manner. At least, that is the difficulty that an uninitiated user of aluminium wire for such purposes will have to consider first of all. Were he initiated, the difficulty facing him would very quickly change from that of joining aluminium conductor wire to the difficulty of choosing a method from among the host of methods that have been suggested: soldering, using one of the numerous flux-solder combinations, ultrasonic soldering with no flux at all, variants of small-scale resistance or flash-butt welding, cold or hot pressure welding procedures, and—right up to date, if only in theory—ultrasonic welding. If the user is really fortunate, however, he may escape both the initial difficulty and any ensuing difficulties by being supplied with aluminium wire that can be soldered in exactly the same way as copper wire, as a result of its being provided with a coating of an easily solderable metal. In that case, it is the suppliers who will be faced with a difficulty, namely, the choice of a suitable coating metal which ranges all the way from tin through zinc and copper, to silver, and combinations of them. For the sake of reliability (freedom from corrosion and from effects of diffusion) one such combination has been extended to include no less than three metals, the aluminium wire being coated by electroplating in succession with zinc (coating 1 millionth of an inch thick), copper (15 millionths of an inch thick) and tin (30 millionths of an inch thick). The initially annealed wire is reduced by 20-25 per cent by cold drawing prior to plating, and subjected to further cold drawing (total reduction from the annealed condition about 35 per cent) after plating. The cold drawing of the plated wire converts the outer tin coating from the matte condition into a condition having the desired soldering and (for twisted joints) contact properties.

Skimmer

Presentation of Metallurgical Information

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In this part of Dr. Jenkin's article, which was presented to Birmingham Metallurgical Society and Sheffield Metallurgical Society, the author deals with the preparation of reports and technical papers. In the remaining portion of this article, which will appear next week, the spoken word, in particular the lecture, will be dealt with.

THE written word may be a simple letter to someone you know well on a subject admitting of no doubt. Even between friends, however, it helps if the subject is at least mentioned in an acknowledgement: I had a letter once that read as follows: "Dear Dr. Jenkin, Thank you for yours of 21st October. I shall wait to hear further from you. Yours sincerely. . . ." One can bring the subject into the letter without recourse to commercial cliches like "I am in receipt of your esteemed favour of the 21st instant and have pleasure in acknowledging same." One has to be a little more careful however if it is a letter to a stranger, for when he reads it he will hear his own voice in his mind, not yours, and put into it his own inflexions as best he can, based upon *your* punctuation, *your* paragraphing, and *your* order of words. If what you write is a request to a colleague, these things may be of great importance; after time and money have been spent in acting upon such a request, it is unsatisfactory to have to say (as I have) "But that is not what I meant."

The forms of writing most exacting to a metallurgist are the Paper to a scientific society and the report to one's chief, be he metallurgist or a mere manager. These two kinds of writing may be quite different things. The scientific Paper must stand up to public criticism from those skilled in the art. It must state what the writer sets out to do, and give the background of previous work. It must give the experimental detail, such as the materials, the apparatus, the method, and the results, and finally must give some interpretation of the results and draw conclusions. Apart from these essentials I doubt whether any set form is desirable; each writer must decide for himself, bearing in mind that he writes for the scientific community, and most such Papers give the results of original research.

On the other hand a report that is not for publication may or may not be concerned with research in the strict sense. It may be an appraisal of some situation with a view to making recommendations for action on the part of the organization we serve. Much of the metallurgical detail may be out of place unless you are reporting to a metallurgist, when it would be essential. It would also be necessary to give that detail if, although it is a report to management, it is likely to be referred to another metallurgist. Some reports are to engineers, to sales executives, or to purely commercial or administrative people. To such folks the conclusions need stating in terms that will be abundantly clear to *them*. In such reports some of the technical points may be elementary, and the more scientific detail omitted. I have indeed heard it argued that reports from metallurgists to non-metallurgists should give no metallurgical reasons at all; this may be all right from a medical man to the lay public, but I do not think there is a case for our following suit.

I have sometimes been invited by those responsible to me to lay down a form of report for documents going to the companies we serve, but I have declined to do so. I feel that it is much more important for each of us to be consistent within himself than to be like somebody else. Each should develop his own style provided the report includes the essentials I have described. Any attempt to conform to a standardized arrangement may lead to an unnatural or forced style. Nevertheless we can fairly be expected to avoid some of the errors that I propose to illustrate later.

Whatever the destination of a report, it is fair to assume that the reader is busy, or tired, or both, and since we must keep him constantly in mind, the first thing he should see on looking at the document (after the shortest possible title) is a summary of the whole thing. That should tell the busy man all he needs to know. In a scientific Paper the summary may also serve as an abstract for the abstracting journals. In what for want of a better term I might call a more practical report, the attractiveness of the summary will govern whether the reader reads any more of it. What the summary says may often depend upon the subject; it may, for example, state or imply why the work was done, how the job was tackled, and what the net results were. Sometimes it may give only the net results. In any case it must be brief and clear, and must convey something. It will not do, for instance, to give a summary like this (and here I draw on my imagination in ignorance of the subject matter):

> This report describes an investigation undertaken to determine the effect of pouring temperature upon unsoundness in a manganese bronze propeller casting. A relation is deduced between this temperature and the density of the product.

This tells the reader practically nothing. It would be far more informative (and impressive) to say, supposing this is what one wanted to say:

> The work described in this report shows that unsoundness in the manganese bronze propeller casting No. —— increases as the pouring temperature rises over the range —— to —— and that the best pouring temperature for least unsoundness, consistent with the mechanical properties specified, is ——°C.

From such an informative summary, the busy managing director can say to his works manager "Please act accordingly"; the works manager will know that in the report itself he can see how the unsoundness does vary with temperature; and the foundry superintendent knows that all his detailed questions about evidence will be answered. Each spends on the report no more time than necessary. These are the sort of reasons why the summary should come first, not last. If the report is a substantial one and dressed in a suitable cover, the summary can well command attention by having a page to itself and by being put right in the middle of that page.

The person who reads beyond the summary will almost certainly next look at the conclusions, which by definition come at the end. They must be concise and definite, even if negative, and if there are more than two of them it helps if they are numbered. The conclusions should not in any sense be a summary of the whole report, which comes at the beginning. If the work is of the sort that could reasonably be expected to lead to conclusions, but hasn't, the chances are that reporting is premature. I recently came across the following "Conclusion" and give it to you as an example of what not to do.

CONCLUSION

> The object of these experiments was essentially to try and reproduce ——————. The experiments have therefore been conducted without regard to any subsequent explanation, the approach being somewhat *ad hoc*. For this reason the drawing of conclusions would appear to be better left until a more systematic study, already embarked upon, has been completed.

This is no conclusion at all. If it was necessary to say anything, it should have been done by a letter or

a progress statement and not by a formal report. You will note how the author took refuge in a phrase beloved of so many of us, "would appear to be." I hasten to add that this was not a report from my own department, but the fact that it reached me from an outside organization shows that it was at least issued to a limited public.

The reader who has been encouraged by the summary to read the conclusions will (if he is attracted and spares the time) turn over the pages of the report and glance at the illustrations. So much can be said on this subject of illustrations that it would justify a lecture in itself, so I must leave most of it unsaid. It is rather more amenable to standardization than the form of the report itself, but again it would be unwise to enforce too standard a pattern. The keynotes are boldness and simplicity, with easily read captions; these ideals are sometimes difficult to achieve with line drawings that are intended to give a lot of information. It helps the reader when tables can be illustrated as graphs, and when graphs can have word titles close to each curve. It helps also if the reader does not need to turn the document sideways to appreciate the legends. Experimental points should be given wherever practicable, but if several curves appear on one graph the result can at times be a confusing array of dots, circles, triangles, squares, and so on. Photographs should be dry mounted on card that is not too stiff, and should be well balanced on the page. It is common to put them all at the end of a report, but there are times (particularly in long and profusely illustrated reports) when advantage lies in their being near the relevant text. A photograph of a photograph is never quite satisfactory. I fully appreciate that there are times when these desirable features about illustrations cannot be achieved.

The text itself, like everything else, must be governed by the type of reader for whom the report is prepared. We must write to serve and not to impress. We must employ the same precision as we have been taught to use in our scientific training. We must save the reader's time by cutting out all unnecessary words, but never at the sacrifice of clarity. Words must have precise meanings and not the everyday use or loose interpretation of literary writing. Here the metallurgist faces a difficulty: he has got into the habit of using ordinary English words for his special meanings. Most scientists and technologists have to invent words so that they have a precise meaning to the initiated; words like encephalitis lethargica, metahydroxyphenol, or logarithmic decrement; the botanist speaks of "epilobium angustifolium, of the family onograceae" when he really means the common rose-bay willow-herb. Even the physicist will write of endosmosis and cataphoresis as if he really knew what they meant. The metallurgist, however, borrows or steals good English words in common use, often real Anglo-Saxon: we speak of hardening, softening, quenching, tempering; of stress, strain, slip, yield, creep, and fatigue; we attach a specific meaning to deformation and to work; we even talk of snowflakes, fish-eyes, and orange peel, let alone upset forging. So we have to be most careful that our readers or hearers know exactly what we mean.

Sentences must not only be clear, but must be clearly connected. The paragraph must be a unity; the break between paragraphs should not separate things that ought to be together. There seems to be a habit amongst some typists of making each sentence a separate paragraph, as is shown by the snippety character of much commercial correspondence. Some people like to have a heading for each paragraph, and their struggles to find suitable headings can be almost comic and certainly distracting. There are few rules about headings, but whatever system we adopt we should stick to. Generally the main sections of a report have centre headings in capitals, and the sub-sections have side headings in small type. The main thing, as pointed out by Dr. Ulick Evans in the Bulletin of the Institution of Metallurgists seven years ago, is that "Each major heading should be a correct description of the whole portion of the Paper up to the place at which the next major heading appears; similarly each minor heading should correctly describe the part which follows it, as far as the next minor heading."

If the report is a bulky document, an index at the end is as useful as a contents list at the start. The very exercise of making a contents list of one's main headings and side headings (even when no contents list is required in the Paper) is a good aid towards making each paragraph a unity.

As to the order of words, we should struggle to ensure that things that should be thought of together are mentioned together. Quite early in my first job as a metallurgist I came an awful cropper because I had the temerity to criticize the English of the man to whom for a particular investigation I was responsible. On the basis of experimental data that I had provided, he drafted a report for publication. The second paragraph consisted of a single sentence 72 words long, and the only verb was the fourth word from the end. The feeling of having to hold one's breath while waiting for this verb to come was dreadful. I ventured (as I thought, tactfully) to point this out. He rounded on me with a torrent of invective, telling me that my duty was to do the experimental work and not to criticize the English of a senior man accustomed to writing reports. Now he always wrote in pencil, and one of his principal tools was a piece of india-rubber. He would never cross out a word in pencil or insert anything: he would rub out any word he wanted to alter, repeatedly if necessary, until he almost wore holes in the paper. So I surreptitiously obtained access to the draft report, rubbed out some of the offending 72-word sentence, re-wrote it in shorter form with the verb next to the subject, and my version duly appeared in print without his ever discovering it.

Once upon a time I was at the National Physical Laboratory under the late and famous Dr. Walter Rosenhain. To serve under his direction was an experience. I need not tell you of his eminence as a metallurgist. He was not only a master of English but of two or three other languages as well, and woe betide any of us youngsters who could not prove that everything we had written was both necessary and sufficient. In a report I once used the phrase "A microsection was carefully prepared . . ." On reading it Rosenhain turned to me and said "Jenkin, do you ever prepare a microsection other than carefully?" Before I could stammer "N-no, Sir," bang went the blue pencil through the redundant word.

On this question of words, their order, and their meaning, I once thought I could improve upon the way in which a younger colleague had expressed a particular sentence in a report going to an outside organization, and I handed him a version I had written as an alternative to his own. He took longer to read it than I expected; when his brows started knitting I said "Here, give it me back. If you have to read it twice there's something wrong with it." And his version stood, not mine.

All of us who have to read reports must have met, as I have, some very singular uses of the plural, like "a phenomena." Confusion is rife between imply and infer, between replace and substitute, between deduct and deduce, and between presume and assume. (You presume what you think is true; you assume what you think might or ought to be true.) The word "quality" gets very misused in the steel trade; when one expects it to mean degree of excellence, it is a shock to read of "35 carbon quality." Worst of all is its use as an adjective; a colleague of mine, knowing what I was in for to-night, invited me to read an American article on this very subject of the writing of reports, and I read "Application of the rules of good grammar and composition is a prerequisite to quality report writing." This habit of stringing adjectives together before a noun is spreading from America to this country: in a Paper devoted to the measurement of residual stresses (so there was no doubt about the subject) I found a reference to a conclusion that "for the optimum residual circumferential stress measurement the dimensions should be . . ." Four adjectives and one noun: "Optimum residual circumferential stress measurement," when in the

particular context the writer could have said "best results." A prize instance, however, reached me as a member of a committee that had to decide whether a certain report should be published, so one must assume that it had already run the gamut of scrutiny by responsible people as well as by the author. The first sentence was as follows, and it commences, as you will see, with seven or eight adjectives before a noun:

> The inert gas shielded self-adjusting metal arc welding process has been used for a number of years to join various metals which are rather more difficult to weld than mild steel, such as aluminium and stainless steel.

This is admittedly a difficult one, because there are those who maintain that one should tell the reader as much as possible at once, and not get his mind on ordinary metallic arc welding first, only to correct it by referring to the inert gas, and then to re-correct it by explaining that you are not thinking of tungsten electrodes. Nevertheless it is ungainly to use all these adjectives, and if you replace them with initials as our American friends do, you are liable to reduce "shielded inert gas metallic arc" to SIGMA, resulting in confusion with the sigma phase in nickel-chromium-iron alloys, which can be detrimental to welds. My feeling is that one is unlikely to have to refer to this process in such a completely descriptive way more than once in a report on it, and that it would be better to turn it round as shown below. But as I said at the beginning, I may well be wrong.

> For a number of years the joining of various metals that are more difficult to weld than mild steel (such as aluminium and stainless steel) has been done by the metallic arc process, using an inert gas shield and a self-adjusting arc.

The observant may have noticed that in re-writing that sentence I have altered the relative pronoun "which" to "that." I have such an evil reputation in this matter that I can hardly be expected to give this lecture without referring to it. The odd thing is that there is much less confusion between these two in American writing, but in this country the misuse of "which" is becoming so common as almost to take on the character of a sanction. It makes me feel that I am fighting a losing battle, but the distinction is quite clearly put by the authorities. Failure to observe it may not only destroy lucidity and ease, but can sometimes be downright misleading, as I should like to show you. "The word 'that'," says Fowler "defines and limits; it is always restrictive. 'Which' on the other hand does not define; it is always continuative." Since "that" merely defines and limits, the whole sentence is complete: "This is the house that Jack built." The word "which," however, adds something; it is a convenient way of bringing an independent thought near to the main subject, and since the thought is independent, the clause can be omitted without disturbing the sense: "This is the house (which Jack built) that I live in."

I have noticed that confusion between these two relative pronouns is commoner in writing than in speech, as if people are under the impression that "that" is colloquial and "which" is literary. This is quite untrue. It seems to me that the reason why we generally use "that" correctly in conversation is that it is natural to make a brief break in the voice or the sense before saying something that is additive or continuative. In writing, such a break would be represented by a comma. The modern tendency to neglect the comma may be responsible for much confusion between "that" and "which." A good guide is this: if the clause can be put into brackets without disturbing the sense, use "which"; in all other cases use "that."

Suppose you came across the phrase shown below:

> . . . under these particular conditions of corrosion. The only recorded opinion which counts for much is that of W. H. J. Vernon, who considers that the . . .

Now this can mean two quite different things. It might mean that there is only one recorded opinion to that effect, and since it is Vernon's, it counts for much. On the other hand, it might mean that there are many recorded opinions, but Vernon's is the only one that counts for much. You may retort that if the second meaning had been intended, the writer would have put the clause between commas. But in fact writers don't do that, though I agree that they should.

Some of you may say "But does it really matter? Isn't all this a bit pedantic? Isn't it better that a writer should be consistent within himself than that he should copy somebody else? And haven't you invented that statement just to make your point?" Yes, I have, but let us turn to something real. In a deservedly famous text book on "Engineering Steels" by a distinguished Past President of this Society (with a co-author in its latest edition) I came across three sentences that I should like to show you. They are from the same chapter, in the same book, by the same author, and each contains two relative clauses; two of them, indeed, contain a third. There were, therefore, three pairs of opportunities of using "that" and "which." In the first instance the author gets both correct:

> Since the direction of the stresses that are set up can be predicted in a broad way, the direction that a crack will take can be forecast approximately.

In the next instance he appears less sure, getting one right and the other wrong:

> A large jagged inclusion, shrinking away from the metal which contains it, may leave its impression in the metal, producing sharp re-entrant pits that may induce stress concentration.

In the third example he gets both wrong:

> External causes of stress raising may be dealt with by the user of the steel. The internal ones are the more dangerous, and a steel which is to be carburised, or nitrided, should be as free as possible from internal stress raisers which run in directions that cause them to multiply the imposed stresses.

You will see that this can mean "a steel . . . should be as free as possible from internal stress raisers, which run in directions that cause them . . ." But that would be quite wrong, because internal stress raisers do not necessarily run in directions that cause them to multiply the imposed stresses. It is only the stress raisers that do run in those directions that cause trouble; the others don't.

I have discussed this matter of "which" and "that" in great detail with the eminent author of the book concerned, and he points out that he does not share my view, and that moreover there is such a thing as "elegant variation." On the latter point I quite agree with him, and as I have stated repeatedly, I may well be wrong.

I have, I fear, described these usages as right and wrong, but I quite agree that in many cases there is no confusion and I should not use the word "wrong." The last example, however, shows that an incorrect use can lead to a wrong interpretation. The point is not that an incorrect use is always misleading, or even often misleading, but that a correct use never is. I was completely fooled recently by a draft standard specification. This was not even a British Standard, but a draft International Standard, which ought not to fool anybody. What is more it might in a dispute between purchaser and supplier have to stand examination in a court of law. The offending phrase was as follows:—

> Test pieces which are machined all over shall be of the form described in the general standard for tensile testing and shall be tested in accordance with the requirements of that standard.

Now this referred to a subject familiar to me, steel tubes, and my first reaction was "My hat! Whoever is going to accept a requirement that test pieces are to be machined all over? Not likely!" So I read it again, more carefully:

Test pieces, which are machined all over, shall be . . . At about the third or fourth reading I realized that it did not say "Test pieces, which are to be machined . . ." but "Test pieces which are machined . . ." Not until then did it dawn on me that this only referred

to such test pieces as had to be machined all over, and that if the writer had said "that" instead of "which" neither I nor anybody else could misunderstand it. There are, as you will see, two possible meanings:

1*st meaning*, unintended:

Test pieces, which are machined all over, shall be . . .

Test pieces (which are machined all over) shall be . . .

Test pieces (and they are machined all over) shall be . . .

2*nd meaning*, intended:

Test pieces that are machined all over shall be . . .

Such test pieces as are machined all over shall be . . .

Now these two meanings are quite different and would have very different consequences. Since these relative pronouns can have two different meanings, I plead that it is wrong to use them indiscriminately. For the sake of avoiding all possible confusion, use "which" only when the clause it introduces can be put into brackets; in all other cases use "that."

My use of the word "case" prompts me to suggest that we might well think twice before using "in the case of." "In case of" is a very different matter, and often necessary, but "in the case of" can frequently be deleted without loss, and sometimes with gain. If I came across the phrase "In suitable cases holders of Higher National Certificates may claim exemption . . ." it would make me think of candidates "in suitable cases" labelled "This side up!" And in metallurgy it is dangerous to talk of a "cast iron case" or "getting down to brass tacks" or a "concrete example," especially if we are speaking of aluminium alloy sheet. But mixed metaphors and confused similes belong more to speech, and there will not be time to mention some of the rich examples that have come my way.

Metallurgical writing is by no means confined to the journals of the learned institutions or the proceedings of local societies like our own. We have also a large and responsible technical press. As distinct from the original Papers of the scientific journals, articles in the technical press may be reviews of existing practice and news of new developments. So the requirements about stating the object of the exercise, the background of previous work, experimental materials, apparatus, methods, and results, and the drawing of conclusions, may not always apply. But all other high standards of presentation do. The technical press is read not only by metallurgists but also by other interested readers who might recoil from a scientific Paper.

At times metallurgy creeps into the lay press, such as the daily newspapers, and here we have a most exacting task. The metallurgist, as I have said, borrows or steals more words from ordinary English usage than any other technologist does, and adapts them to his own more specialized purposes. The danger in this rather lazy practice comes when metallurgical news gets into the lay press, as we saw in popular accounts of the Comet disasters. Even the Comet report itself used such expressions as that the failure of the pressure cabin was "due to," "caused by," and "brought about by" fatigue. There is a risk that in the lay mind the analogy with human fatigue may be pushed too far, leading to a popular impression that in some mysterious way metals get tired, and can recover. It seems to me quite wrong to say that the Comet failures were "caused by" fatigue. "Fatigue" is merely a word we use to cover our ignorance of the mechanism; it is no more explanatory to say that failure is "due to" or "caused by" or "brought about by" fatigue than to say that the corrosion of steel is due to rusting, or that something is getting hotter because its temperature is rising.

The word "fatigue" has been used by metallurgists and engineers for at least half a century, and it is now too late to bemoan an unhappy choice. Many writers have expressed their regret at its vagueness. By common usage it has been regarded as signifying "the behaviour of metals under repeated stresses," which must therefore cover every change, if any, from the initial application of the stress onwards, whether failure ensues or not. It is true we have got away from the term "fatigue limit" to the use of "endurance limit" but there is still loose talk about "fatigue strength" or "resistance to fatigue." The failure of the pressure cabins of the Comets is far better described without the use of the word "fatigue" at all: the cause was evidently repeated stresses concentrated in a particular region to a greater extent than was anticipated. There can be a world of difference between saying that the stresses were too high and saying that the metal was too weak. Failure to appreciate the distinction led one eminent witness at the Comet enquiry (no less a person than the Chairman of the Air Registration Board, Lord Brabazon) to say that the cause of the disasters was "the venturous pioneering spirit of our race," and (or so he is reported to have said) "it is metallurgy, not aeronautics, that is in the dock." Nothing could be more damaging or more false. The term "fatigue failure" may it is true imply ignorance of the properties of metals, or some unsuitable choice, or faulty condition; it can also mean an inability on the part of the engineer to compute stress concentration factors and how they may vary under continued cyclic loading, and hence, understandably, to say what stresses he wants the metal to carry.

As if to make confusion worse confounded, we now have an American move to use the phrase "static fatigue," which on the old accepted definition (of fatigue) is a contradiction in terms. It seems that in some steels heat-treated to very high tensile strengths, failure can occur under prolonged static loading over some 50 or 100 hours at stress levels not more than about 80 per cent of the short-time ultimate, all at ordinary temperatures. If this is to be labelled "fatigue," I give up. I much prefer the proposal of one of my former colleagues, Dr. A. G. H. Coombs (who has worked in this field), that if the word "fatigue" is to be used at all, it should be used only as an adjective and not as a noun, and that the detrimental changes on prolonged loading should be known as "cumulative damage," whether dynamic or static.

(To be concluded)

Arc-Melted Copper

WITH a diameter of 18 ft. and a bath capacity of 90 tons of molten metal, an arc melting furnace for copper that can continuously produce 30 tons of high-quality tough pitch copper per hour has recently been put into operation by American Smelting and Refining Co.

Its transformer is rated at 8,000 kVA with a maximum rated current of 30,400 amp., and the three 18 in. diam. graphite electrodes, when assembled, weigh 4,000 lb. each. Their positions, which determine the arc length, are controlled hydraulically

In an area of high power cost (about 1 cent per kWH), it is claimed that the furnace is competitive with the fuel oil-fired reverberatory furnaces conventionally used throughout the industry.

For the first time, an oil-fired preheating furnace is combined with the electric arc furnace to use both sources of heat at optimum efficiency. Copper in the form of cathode sheets is heated to 820°-870°C. in a rotary pre-heating furnace. In addition to heating the copper with relatively inexpensive oil, this step permits a low-sulphur feed to the arc furnace. The heated, low-sulphur cathodes are then transferred to the arc furnace, where the copper is melted and heated to 1,150°-1,180°C. The molten metal is cast at 1,110°C., flowing down a launder to a 10-ton electric holding furnace, where its temperature and oxygen content are precisely regulated prior to casting.

The operation of an arc furnace to melt copper poses special problems. Obtaining the necessary sensitivity of control in combination with rapid motion of the massive electrodes and their holders was a formidable requirement. It was accomplished by utilizing a rotary regulator and controls actuating an hydraulic servo system.

Tests show that electrode control is very rapid. Despite the need to handle 10 tons of electrodes and holders, full reversal of the electrodes can be accomplished in ½ sec. when the electrodes are travelling at a rate of 10 ft/min.

Finishing Supplement

Effluent Problems

By F. WILD, A.I.M.
(*R. Cruickshank Ltd.*)

II—CHEMICAL TREATMENT

(*Continued from* METAL INDUSTRY, 24 *January*, 1958)

FIVE main effluents affect the plating industry, and these are:—

(1) Effluent containing acids or alkalis, or metallic salts, or a combination of metals and acids, or metals and alkali. These are derived from cleaning, pickling of metals in acid, and plating solutions such as nickel, tin and acid copper, but not cyanide solutions.

(2) Unpolluted effluent from cooling coils, washing water and domestic type sewage.

(3) Effluent containing chromates, from chrome rinses, Bengough Stuart anodizing solutions, and sundry chromate processes such as passivating and chromating.

(4) Effluent containing cyanides, produced from cold cyanide cleaning solutions, copper, zinc, brass and other cyanide solutions, and also quenching waters from cyanide hardening shops.

(5) Effluent containing emulsified cutting oils, e.g. suds, oil.

These wastes are, in many cases, mixed together, in which case their treatment to a non-toxic effluent is extremely difficult, if not impossible. If really effective treatment is to be carried out, the waste must, as far as possible, be segregated by suitable drains into the various types mentioned in the foregoing.

Due to the variety of metal finishing and allied processes carried out, there can be no general recommendation for all plating shops, and each shop must be treated on its own merits with respect to the following points:—

(1) Types of processes; (2) types of work being processed; (3) drainage system; (4) space available for treatment plant; (5) requirements of local authority or River Board; (6) cost and availability of water; (7) scale of charge for reception of effluent, if in force; (8) general economics of space and money; (9) ratio of non-toxic effluent to toxic effluent from the factory; (10) possibility of self-neutralization of various effluents.

Acid and alkali wastes containing metallic salts. In general, most plating shop wastes of this type are acidic in nature, in which case the metal salts are in solution. These wastes can be rendered alkaline by the addition of caustic soda solution, soda ash solution or lime slurry. The use of lump limestone, in pits over which the effluent passes, is not recommended owing to the formation of insoluble calcium sulphate on the surface of the lime, when sulphates are present, which renders the lumps inert.

After neutralizing the acid, the *p*H is generally allowed to rise to *p*H 8 or 9, when the metallic salts precipitate out as insoluble material, which can be removed by settlement.

Whilst lime is cheap, it must be remembered that it is less efficient and produces much more sludge than soda ash or caustic soda, due to the formation of insoluble calcium salts. However, it has been found that copper from Rochelle copper solutions, which contain tartrates, will not precipitate unless a certain amount of lime is present. This is due to the formation of complex soluble tartrates, in which case the tartrate must be precipitated as calcium tartrate. This treatment must be borne in mind when dealing with cyanide wastes containing copper tartrate.

The neutralization treatment is generally carried out in a pit of sufficient capacity such that the solution takes about 15 min. to pass through it. The treated effluent then passes to settling pits, giving a settling time of 2-4 hr., when all insoluble metallic salts will settle as a sludge.

The neutralizing process can be controlled by a *p*H controller, which operates an injector pump feeding lime slurry or soda ash solution. However, in most small installations the addition of alkali is made by trial and error methods, using litmus paper.

Metal-containing wastes can also be treated by the ion exchange method, with subsequent acid neutralization, but up to the moment this has a very limited application in this country, due to its high plant cost. It is, however, being used in the U.S.A. for the recovery of semi-precious and precious metals from wastes, as well as the recovery of chromic acid from plating rinses and anodizing solutions.

Unpolluted cooling waters and domestic type sewage. Effluents of this type come from degreasing plants, water-cooled rectifiers and solution-cooling coils. They should be added to the effluent after treatment, thus acting as a diluent and reducing the concentration of toxic material.

Effluent containing chromates. There are two main methods in use for the treatment of chromate wastes. The first utilizes a bed of witherite (barium carbonate) over which the effluent passes. The barium carbonate forms insoluble barium chromate, but when the surface of the witherite is coated with barium chromate the reaction ceases. The witherite bed is then removed and rotated in a barrel in order to remove the insoluble barium chromate. After barrelling, and washing away the barium chromate, the witherite bed is again laid. This method is not satisfactory for obvious reasons.

The second method uses a reduction process, followed by precipitation of chromium salts and settling out of the salts as sludge. The reducing materials used are ferrous sulphate, sodium sulphite, sodium bisulphite, sodium metabisulphite or sulphur dioxide. Ferrous sulphate is mainly used in this country, but in the U.S. many of the large plants use sulphur dioxide, which has the advantage that only chromium sludge is formed and not a mixture of both iron and chromium sludges, which is, of course, much more bulky to deal with during subsequent sludge disposal.

If ferrous sulphate is used, the *p*H should be about 1·5 for complete reaction, but if sulphur dioxide or sodium sulphite is employed, the *p*H may be allowed to rise to 2.

The reaction occurring with ferrous sulphate is represented by:

$$6\,FeSO_4 + K_2Cr_2O_7 + 8\,H_2SO_4 = 2\,KHSO_4 + Cr_2(SO_4)_3 + 3\,Fe_2(SO_4)_3$$

this representing 16·04 parts by weight of ferrous sulphate to reduce 1 part by weight of hexavalent chromium. In actual practice it has been found that the amount of ferrous sulphate required is much higher.

Using sulphur dioxide, the amount required is about three times by weight that of the chromic acid. The reaction occurring is given by:

$$H_2Cr_2O_7 + 3\,H_2SO_3 = Cr_2(SO_4)_3 + 4\,H_2O$$

The use of sulphur dioxide requires special plant and, although very efficient, it is only suitable for large installations, due to high plant cost. Although sulphur dioxide is much dearer than ferrous sulphate, the respective amounts used for reduction of a unit amount of chromate reduces the price such that there is little to choose in actual cost.

The ferrous sulphate method has gained favour in this country owing to it being relatively simple and inexpensive and requiring no expensive equipment, although it suffers the

TABLE I—RELATIVE AMOUNTS OF CHEMICALS USED IN SOLUTION TREATMENT

Chemical Dosage (lb. of Reagent/lb. HCN)			Solution Treated					
			Potassium Cyanide (CN p.p.m.)		Sodium Zinc Cyanide (CN p.p.m.)		Sodium Cuprocyanide (CN p.p.m.)	
			Before	After	Before	After	Before	After
Ferrous Sulphate Method								
15·4			95	4				
20·6					113	6		
196·0							73·5	10
Alkaline Chlorination Method								
Caustic Soda (NaOH)	**Bleaching Powder (36 per cent chlorine)**	**Sodium Thiosulphate**						
2·2	8·1	0·2	87	0·1				
2·3	8·1	0·2			89	0·1		
4·6	8·8	0·3					77	0·1

disadvantage of producing excessive amounts of sludge.

After reduction, which takes about 30 min. for completion, alkali is added, as lime slurry, caustic soda or soda ash solution and the chromium salts precipitate out, together with iron salts, if ferrous sulphate is used. The solution is then passed to the settling pit.

This final treatment is the same treatment applied to acid non-cyanide metal-containing wastes and these two types of effluent can be combined, as metal-containing wastes do not interfere with the chromate reduction. The *p*H of the effluent must, however, be reduced to *p*H 1 by the addition of acid if necessary, to ensure completion of the chromate reduction.

The sludge formed is non-toxic and it should be removed periodically from the settling pit and deposited on a suitable site.

Cyanide-bearing wastes. In general, these types of wastes come from plating solutions, cleaners, hardening salts, stripping solutions, rinses and quench water.

There are several methods for the destruction of cyanides in use, such as boiling in a slightly acid solution, lime-sulphur treatment, hot electrolytic oxidation, ferrous sulphate-lime and oxidation by permanganates, hypochlorites or chlorine.

Boiling and aeration can only be used on batches, and although used in the U.S., the fumes produced are highly toxic, and special extraction equipment is required.

The lime-sulphur process converts the cyanides to thiocyanate, which is, in itself, fairly toxic, and there is evidence that some cyanide is left in the resulting solution. This process has not gained much favour.

Hot electrolytic oxidation of cyanide solutions, using high current density and steel anodes, can only be used as as a batch treatment, and the process is somewhat expensive to operate due to heating costs.

The ferrous sulphate-lime treatment has been used for many years in this country and depends upon the conversion of alkali metal cyanides to insoluble double iron cyanide according to the equation:

$$5\,KCN + 2\,FeSo_4 = KCN.\,2\,Fe(CN)_2 + 2\,K_2SO_4$$

In the absence of air, residual cyanide concentrations of the order of 0·2 p.p.m. are left in the treated effluent, but in the presence of air about 5 p.p.m.

The amount of ferrous sulphate used to process 1 lb. of cyanide (as HCN) is between 15 and 20 lb., at *p*H values of 8 to 9, but complex metal cyanides increase this figure. Nickel cyanides, which are the result of mixing nickel-bearing and cyanide-bearing effluents together, are not broken down by either this process or the chlorination process.

As this process can only operate in alkaline conditions, milk of lime should be added to the effluent if necessary.

Although ferri- and ferro-cyanides are not very toxic, they tend to break down under the action of light and oxygen, producing cyanides which may escape into the treated effluent as well as giving sludge disposal difficulties. This process generally reduces cyanides to about 5 p.p.m.

Effluent treated by this process is suitable for discharge into sewers only, where the dilution by other non-toxic sewage reduces the cyanide content still further.

Oxidation by hypochlorites, or chlorine, would seem to be the most common method for efficient removal of cyanide, the cyanide being oxidized by chlorine under alkaline conditions to carbon dioxide and nitrogen, the reaction occurring in three stages:

Oxidation of cyanide to cyanogen chloride

(i) $NaCN + HOCl = CNCl + NaOH.$

Oxidation of cyanogen chloride to sodium cyanate

(ii) $CNCl + 2\,NaOH = NaCNO + NaCl + H_2O$

Oxidation of sodium cyanate to carbon dioxide and nitrogen

(iii) $2\,NaCNO + 4\,NaOH + 3\,Cl_2 = 2\,CO_2 + 6\,NaCl + N_2 + H_2O$

The third oxidation process would appear to be somewhat uncertain, and, in general, the effluent treated to stage (ii) is acceptable, cyanate being only one-thousandth as toxic as cyanide.

Chlorination can be carried out using chlorine gas, which is added to the effluent using special chlorination plant, or by the addition of sodium or calcium hypochlorite.

Gaseous chlorination is generally restricted to large effluent treatment installations, due to the cost of the plant, although it is the most efficient method. For small plants, sodium or calcium hypochlorite is used. The former is generally supplied as a 15 per cent solution containing 7 per cent available chlorine, whilst calcium hypochlorite contains about 35 per cent, but the latter suffers from a disadvantage in producing excess sludge whilst, at the same time, additions of sodium hypochlorite solutions are much more easily controlled.

Theoretically, the oxidation is almost instantaneous, but in practice a reaction time of about 45 min. is recommended.

The *p*H for this oxidation should be in excess of *p*H 11, and as the *p*H reduces in the reaction it may be necessary to add further alkali.

Any excess chlorine which is in itself toxic should be destroyed by the addition of sodium thiosulphate solution, after the completion of the oxidation of the cyanide.

Periodic checks should be made on the treated effluent, using a starch-potassium iodide test paper, which turns blue in the presence of excess chlorine.

A comparison in the amounts of chemicals used in the ferrous sulphate and chlorination method is shown by work carried out by Pettet, data for which are given in Table I.

Basically, cyanide bearing wastes should be treated in the following steps:

(1) Adjust the *p*H value of the effluent to 11 by the addition of caustic soda or lime.

(2) Add the chlorinating material, either sodium hypochlorite solution or calcium hypochlorite suspension.

(3) Allow time for the reaction to occur.

(4) Remove excess chlorine by the addition of sodium thiosulphate solution.

(5) Settle out any metallic salt insolubles.

(6) Re-adjust *p*H of remaining liquid to suitable figure.

One important point is that amongst many electroplaters there is an opinion that the addition of an acid to a cyanide waste destroys the cyanide. This is not so; the cyanide, as sodium or metal salt, is merely converted to hydrogen cyanide or prussic acid, and the toxicity is just as great. There is also an opinion that if cyanide and chromate wastes are mixed, the chromate will oxidize the cyanide. There is no evidence as yet to show that this reaction will satisfactorily destroy both cyanide and chromate by self-neutralization.

In general, when designing any effluent treatment scheme for a plating shop, division of the effluent into three main types should be attempted. These types are:—

(1) Chromate, acid, nickel and other acidic metal-bearing wastes.

(2) Cyanide, strong alkali and metallic cyanide salts.

(3) Non-toxic weak acid or alkaline wastes not containing metallic salts.

The chemical treatment of the chromate and cyanide type wastes has been described previously, and within limits these two treated wastes can be used to neutralize one another, although further additions of alkali or acid may be necessary.

Subject to certain considerations, the non-toxic, non-metal-bearing wastes can be added after settlement in order further to reduce any remaining toxic material. The other advantage of this procedure is that the volume of wastes which require settlement is reduced and thus smaller pits are required.

In the layout of any medium or large size effluent treatment scheme, provision should be made for bulk disposal of cleaners, acid pickles, etc., the usual procedure being to divert the solution by suitable valves into storage pits, from where it can be fed gradually into the plant during normal operation.

(To be concluded)

INSTALLATIONS AT NEW WORKS OF BRITACHROME CO. LTD.

Planning for Plating

WHEN considering the construction of new factory premises to house a modern plating plant, certain essential requirements have to be taken into account. These requirements may well differ to some degree as between one concern and another, since the class of work undertaken may vary widely. In the case of one firm, Britachrome Ltd., who have recently moved to new premises at Cope Street, Spring Hill, Birmingham, 18, the requirements necessary to ensure full and continued production as near to automatic conditions as possible were considered to be:—

First, ample room to give maximum mobility with minimum movement of operators between cleaning and plating vat positions. Second, sufficient depth of vat consistent with the majority of customers' goods, together with maximum solution capacity to allow the longest possible time between clarification periods, thus maintaining the fullest continuous production time. Third, each vat as far as possible to be a self-contained unit in regard to current supply, filtration and air agitation, to facilitate maintenance and repair services where necessary, so that a programme could be scheduled and continued with the absolute minimum loss of production.

Probably the most time-consuming, exhausting and patience-destroying of all conditions in a plating shop is the climbing and traversing of wooden steps and duct boards raised above the floor level to enable operators to reach and load a vat of, say, 3 ft. to 4 ft. in depth. To overcome this, a standard of 2 ft. multiples was adopted (i.e. nickel vat No. 1 8 ft × 4 ft × 4 ft., swills 4 ft × 2 ft × 2 ft., cleanser 4 ft × 2 ft × 4 ft.). Thus, in order to obtain minimum vat height allowed under factory regulations, a pit some 60 ft. long and 9 ft. 3 in. wide was excavated the length of the plating shop of 1 ft. 6 in. finished depth, into which the plating vats were placed, with gangways between made up of dowelled legs and battens easily movable for cleaning and servicing.

The first obstacle was drainage. A survey was made of the position of the main sewer and, due to a slight fall in the roadway, it was found that an entry to the main sewer could be used 4 ft. below the finished floor level and 3 ft. approximately below the top level of the expensive non-productive, space-consuming effluent pit.

The problem of linings also presented several difficulties. Acid proof tiles were chosen, bonded with acid proof cement. This work was undertaken by Ancorite Ltd., together with the complete lining of the effluent pit, and up to the time of writing no attack on the floor or walls is apparent.

All main gangways are 4 ft. in width, with 2 ft. walks between vats, thus enabling operators to walk and pass freely on the production floor. Eventually, a conveyor will be installed to carry the wired-up and racked work from the wiring room through the straight line of degreasing, cleaning and etching processes, returning to the drying, unwiring and viewing room, and so to the despatch department for packing and despatch to customers.

Westinghouse rectifiers have been used throughout as far as possible. Where generators from the old works were found to be in good condition and suitable for the job in hand (i.e. correct voltage and sufficient capacity)

General view of the bright nickel plant

Part of the hard chrome plating section with wiring up stations on right

these had to be used. Of these, four were found in good condition, and after a thorough clean and overhaul were put into use. These were one 10 V 1,000 amp; one 12 V 500 amp; one 10 V 750 amp; one 12 V 750 amp. To complete the plant requirements, further rectifying equipment was necessary as follows:—six 7 V 1,000 amp. rectifiers, five 7 V 300 amp. and one set of three in parallel giving 12 V 375 amp. (the latter were some years old but were in good condition).

All these units, with the exception of those serving the hard chrome, are housed outside the plating area and controlled at the vat by the usual means. For hard chrome, three vats are already installed, two small vats needing 500 amp. and one 10 ft × 2 ft × 5 ft. using 2,000 amp. Another two are about to be installed of 4 ft. 6 in × 3 ft. 6 in × 6 ft., needing 1,000 amp. each.

A barrelling department has been installed with all the required finishes called for by customers. These have been standardized as far as possible to facilitate changeover and regular maintenance, with one spare unit to put in in cases of serious breakdown.

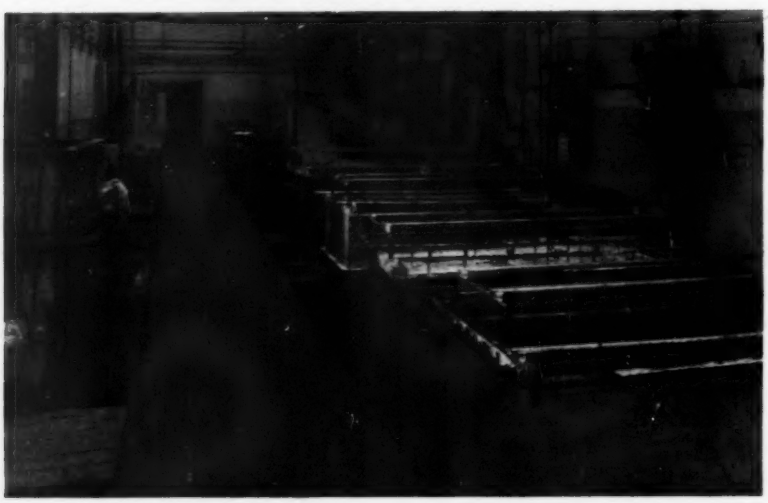
To complete the production layout, a polishing department having five double-end spindles, one backstand unit and one special-purpose machine, is now in full operation in a shop adjoining the main plating department.

A fitting shop has been installed which will eventually be equipped to handle all but major breakdowns, and also for making plating jigs and racks which become necessary from time to time to handle not only the huge variety of decorative work but the many and varied "one off" jigs for hard chrome plating.

The whole works is served by a pair of boilers of 750 gal. capacity, oil-fired with the latest Brockhouse self-contained automatic oil-firing burner capable of consuming 8 gal. of heavy oil per hr. Up to the time of writing, only one boiler has been necessary, except during long periods of laying off, such as week-ends and holidays, when the nickel vats are kept at about 100° to 110°F. by immersion heaters, giving the opportunity of raising the vats to working temperature in as short a time as possible.

Adjacent to the main production area, a laboratory has been fully equipped to analyse all the solutions and deposits, and to do small sample plating in a pilot plant, thus ensuring not only the necessary standard of purification of the solutions but the standard of deposits required by customers.

General view of zinc and cadmium plating vats



Testing *p*H Meters

FOR quickly checking and localizing faults on *p*H meters and on *p*H electrode systems, and for assisting in the checking and setting up of industrial *p*H measuring, recording and control gear, a *p*H meter test set has been introduced by A. M. Lock and Co. Ltd., 79 Union Street, Oldham, Lancashire.

This *p*H meter test set consists basically of a long-life dry cell, across which is connected a number of high stability resistors forming a potentiometer. These resistors connect to a multi-position selector switch, which selects an increasing number of millivolts as it is rotated in a clockwise direction, each step approximately to 2 *p*H units.

A number of interconnecting leads is provided for connecting to the *p*H meter under test. Two output connections to the *p*H meter are provided, a low impedance one and a high impedance one of approximately 250 megohms to simulate the high resistance of normal glass electrodes.

No electrical knowledge is required to operate the instrument. Full operating instructions, together with some general information on the use and care of *p*H electrodes are provided with each test set.

Metal Cleaning

OVER 225 new references are contained in the 1957 "Metal Cleaning Bibliographical Abstracts," including coverage of cleaning by ultrasonic means; cleaning stainless steels and titanium; cleaning semiconductors such as germanium. This book supplements the previous issue, STP 90-B, which covers the years 1842 to 1951; and the 1954 supplement, STP 90-C, which covers the years 1952 to 1954. This 1957 supplement brings the references up to 1956.

Copies of this book may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., at $2 each.

Reviews of the Month

NEW BOOKS AND THEIR AUTHORS

ENGINEERING METALLURGY

"Engineering Metallurgy." *By Raymond A. Higgins. Published by The English University Press Ltd., London. Pp.* 404. *Price* 25*s.* 0*d.*

THOSE of us familiar with metallurgical text-books must agree that much "old wine" is being sold in new bottles under the designations of "Metallurgy for Engineers" and "Engineering Metallurgy." Even so, we must take care that no attempt is made to close the door against new authors in any field of technological knowledge.

"Knowledge is power," although many engineering students do not realize its true significance. Knowledge is not just education; this is proved by the fact that knowledge exists before it is acquired by education. The wise engineer, by education and reading, obtains knowledge and applies it; it enlarges his view and opens up the narrow path of his profession into a wider avenue.

This volume on "Engineering Metallurgy" aims at presenting the necessary basis in "theoretical metallurgy" for Higher National Certificates in Mechanical or Production Engineering. The author even assumes that the work may be helpful to students taking City and Guilds Final Certificates in Metallurgy.

Every engineer should make a point of acquiring theoretical and practical knowledge of metals underlying his everyday work; the cause and effect of using different metals, and their physical and mechanical properties before and after heat-treatments. The harmonious working of machinery designed by the engineer depends to a large extent on the knowledge of metallurgy. Higgins has compiled this book to offer a helpful approach to the general aspects of ferrous and non-ferrous metallurgy.

The reader is taken along a short by-pass of iron and steel production and extraction metallurgy; then comes physical metallurgy, embracing microscopic structures and their relation to the heat-treatments and physical properties of metals; welding and joining of metals; surfacing for corrosion resistance and wear resistance; the theory of corrosion and its prevention, etc.

The author introduces numerous diagrams and tables to enable his readers to concentrate on a particular subject. This is a real accomplishment which should advance any student in his study of metallurgy. Too many students ascribe their examination failures to ill-luck, when they should be really attributed to want of forethought, careless thinking, and lack of association of ideas.

The book is well balanced on the subject of ferrous and non-ferrous metallurgy. The chapters on copper and aluminium alloys are well done. However, this book is not above criticism. For example, the author writes on the "Advantages and Disadvantages of Nitriding," but not the advantages and disadvantages of carburizing, etc. The author suggests that if the nitrided component is accidentally overheated, the surface hardness will be lost and may be decarburized. In nitriding this is almost impossible, and in this reviewer's experience such a phenomenon has not occurred during 27 years' connection with nitriding steel. There have, however, been numerous cases of cracking occurring in carburized components through overheating.

The author is to be complimented on his photomicrographs and equilibrium diagram illustrations in particular and, let it be said, all his diagrams and tables are a worthy contribution to metallurgical teaching. This is a good book and is offered to the student at a very reasonable price.

I. W.

BLANKING AND PRESSING

"Wirtschaftliches Ausschneiden von Blechteilen." *By Dipl. Ing. Friedr. Schachtel. Published by Springer-Verlag, Berlin. Pp.* 100. *Price D.M.*13.50.

THIS is an excellent and practical little book dealing with efficiency and economics of blanking or pressing components out of sheet materials. It is elementary in detail and concise.

Efficiency in blanking out components by means of dies in a press must, in the first place, be based on correct formation of the parts to be produced. The right formation is a major factor in economy, and hence in efficiency since efficiency is economic productivity.

Several pages are devoted to geometry and geometric illustrations. The author demands that his reader must study the line of action towards the end he seeks, and follow it with a continuity of purpose. The path to success in this type of operation is clearly marked out by the numerous illustrations which the writer shows in the following pages. There are many examples and calculations given to enable the greatest number of components to be obtained from a given area of material with a minimum of waste.

Each operation from the simplest to the complicated is shown; some are theoretical, others practical, but all are related to the conception and the execution. Whether simple or complicated operations and designs are being described, an analytic process is observable in the text.

Efficiency and economy are emphasized by eliminating superficial material, such as rim losses, etc. Numerous designs of frame pressings and grilles are shown, with suitable application of the material pressed and blanked out, in order to illustrate economy in material used and lost as scrap.

Over 60 per cent of the pages in the book are devoted to showing illustrations in design and comparisons of good and bad procedure, all of which are supplemented by text and calculations and formulae.

D. Ll.

LEAD SMELTING

"Difficulties Encountered in Smelting in the Lead Blast Furnace." *By R. W. Ruddle. Published by The Institution of Mining and Metallurgy,* 44 *Portland Place, London, W.*1. *Pp.* 56. *Price* 7*s.* 6*d.* (5*s.* 0*d. to members*).

LARGELY a critical survey of the work of Oldright and Miller contained in 16 reports of the U.S. Bureau of Mines published between 1929 and 1934, this booklet aims at making more accessible the details of these reports, and it also provides discussion of them in the light of later experience.

The review is in three main parts: the first contains basic information on the blast-furnace operating conditions at Tooele, Kellogg and Trail smelters; the second is devoted to the formation of accretions at these smelters; and the third deals with the factors governing the lead contents of the slags. There are general discussions on accretions and lead losses, and suggestions for lines of research concerning these aspects of lead smelting.

AUTOMATION

"Automation in Practice." *By S. E. Rusinoff. Published by The Technical Press Ltd.,* 1 *Justice Walk, Chelsea, London. S.W.*3. *Pp.* 261. *Price* 55*s.* 0*d.*

IN an age devoted to specialization, forced on to it by the rapid expansion of the frontiers of knowledge, the "digest," in one form or another, has become widely accepted as a means of communication between the specialist and the layman, and between specialists in one field and those in another. In the latter case, "digest" should be more accurately transcribed as "abstract" and, with the increasing volume of scientific and technical literature, the abstract has become essential in keeping in touch with the work of other investigators in

the field. Another form of "digest," now very common, is that which sets out to explain complex technical processes in lay terms, or in very condensed form, for the benefit of the general public or non-specialist student. Into this category falls the book at present under review.

"Automation in Practice" is American in origin, emanating, indeed, from the American Technical Society. In the preface it is claimed to be "the first book of its kind." It is also referred to as "an authoritative textbook." One is reminded of Dr. C. E. M. Joad and the early Brains Trusts—"It depends what you mean by . . ."

It does, indeed, depend what you mean. As a lay person's introduction to the complexities of automation, and the electronic and other devices which have made automation possible, and as a brief outline of some applications, the book ranks high. In its preliminary chapters, in which it deals with some of the devices used — pneumatic, hydraulic, electrical and electronic—it does use the text-book approach, although the student could hardly go far with the material presented here.

In the remainder of the book, the last nine of its fourteen chapters, automation in specific aspects of production is dealt with; for example, in material handling, in production of metals in presswork, in heat-treatment, and so on. Clearly, so extensive a field can only be dealt with either by the selection of typical examples or else very cursorily. As an example, three short paragraphs cover mechanical sand handling for metal casting, although four pages, two of text and two of illustrations, are given over to automatic moulding. More space is devoted to presswork and machining operations, as would be expected, and some of the descriptions of the devices in use may provoke thought and lead to new applications and, hence, speedier or more efficient production. This is, perhaps, the value of this book; it surveys the field of automated processes, describes some typical methods, and, in doing so, collects much into its covers that would be sought with difficulty elsewhere.

Men and Metals

Appointments to the board of Reynolds TI Aluminium Limited have been announced as follows:—**Sir Ivan A. R. Stedeford,** K.B.E. (chairman), **Mr. R. S. Reynolds, Jnr.** (alternate chairman), **The Lord Reith,** P.C., **Mr. W. G. Reynolds, Mr. J. L. Reynolds, Mr. J. H. McConnell, Mr. A. J. S. Aston,** and **Mr. R. D. Young.** It is also announced that **Mr. Paul R. McGehee** has been appointed chief executive (manufacturing and technical) and **Mr. Basil James,** chief executive (sales) to the company.

Works production manager for the group, **Mr. C. R. Woodfield** has joined the board of Wakefield-Dick Industrial Oils Limited. The following staff appointments within the group are also announced:—**Mr. C. W. Page, Mr. D. S. Kirkpatrick, Mr. F. Rogerson** and **Mr. H. B. Towle,** to be regional sales manager, and **Mr. M. Nicol** to be regional sales promotion manager.

Staff changes are announced by Harshaw Chemicals Limited, of Waltham Cross. **Mr. Jack Weaver** has joined the company as assistant general sales manager. He will continue to reside in Birmingham in order to provide effective coverage of electroplating customers in the Midlands. **Mr. R. T. F. McManus** continues as technical service manager for the company and will work closely with Mr. Weaver to give thorough technical assistance to users of Harshaw processes.

Having resigned his position as N.I.F.E.S. area engineer in the North-East, **Mr. L. E. Nichols** is proposing to re-enter consulting engineering practice. For the time being, **Mr. George Gill,** area engineer in the North-West, will also be exercising general supervision over the Leeds, Sheffield and Newcastle offices of the National Industrial Fuel Efficiency Service.

Recent changes in the boards of the Vickers group are announced as follows:—**Mr. P. H. Muirhead,** C.B.E., has resigned his appointment as managing director of Vickers-Armstrongs (Engineers) Limited, and his directorship of that company, but will retain his other group directorships for the time being; he remains on sick leave. **Mr. W. D. Opher,** M.I.Mech.E., has been appointed managing director in succession to Mr. Muirhead. Mr. Opher and **Mr. R. P. H. Yapp** have been appointed special directors of Vickers Limited, with effect from February 1 last.

Leaving this country, with his family, for Australia, **Mr. Hugh H. Baird** has resigned his directorships of Baird and Tatlock (London) Limited and Hopkin and Williams Limited.

Sécrétaire général of Société Miniére et Métallurgique de Penarroya, **Mr. M. De Boissieu** has joined the board of H. J. Enthoven and Sons Limited. **Mr. F. Brearley,** the secretary of the company has also been appointed a director.

On appointment as finance manager to The British Oxygen Company Limited, **Mr. A. D. Smart** relinquishes the post of secretary to the company. He is succeeded in this latter position by **Mr. B. R. D. Clark.**

News from Midland Silicones Ltd. is that **Mr. K. A. M. Barton** (sales director) and **Dr. R. A. Gregory** (production director) have been appointed joint managing directors of the company. **Mr. S. Barratt,** the former managing director, continues to serve on the board as a non-executive director. It will be recalled that Mr. Barratt was recently appointed chairman of Albright and Wilson Limited, parent company of Midland Silicones Limited.

Chairman of the Mond Nickel Company Limited and of Henry Wiggin and Company Limited, **Mr. L. H. Cooper,** M.B.E., has been elected a director of the International Nickel Company of Canada Limited.

In connection with the new company recently formed—Yorkshire Imperial Metals Limited — representing the fusion of the interests of the Yorkshire Copper Works Limited and certain interests of the Metals Division of Imperial Chemical Industries Limited, the board of directors of the new company has now been announced as follows:—from I.C.I.: **Dr. James Taylor, Dr. Maurice Cook, Mr. P. T. Menzies, Mr. St. John Elstub, Mr. H. Royle** and **Mr. Walter N. Ismay.** From Yorkshire Copper Works: **Mr. G. P. Norton, Mr. H. F. Sherbourne, Mr. W. R. D. Macdonald, Mr. C. G. Robinson, Mr. Donald Fraser, Mr. J. Christie,** and **Mr. Clifford Breckon.** It is understood that Dr. Taylor will be chairman of the company, Mr. Norton deputy chairman, and Mr. Sherbourne managing director.

Zone Refining

PURIFICATION of metals by zone refining has received a considerable amount of attention in the past year or two, and in the preparation of metals used in semiconductors the process has received wide application. An admirable survey of the process is given in a booklet published by The Royal Institute of Chemistry as No. 3 in its series of Lectures, Monographs and Reports.

The author, N. L. Parr, discusses equilibria during solidification, the principle of molten zone refining, and then goes on to discuss the process in practice. Horizontal and vertical methods are described, atmosphere control, the floating zone technique and secondary effects are mentioned. Some specific applications are dealt with, and general fields of application are surveyed.

The booklet contains a number of diagrams and half-tone illustrations showing arrangement of apparatus. It is available, price 5s. 0d., from the Institute at 30 Russell Square, London, W.C.1.

Industrial News *Home and Overseas*

A Removal

It is announced by **Trans Metal Limited** that they have now moved into their new offices at Temple Court, 55 Temple Row, Birmingham, 2. Their telephone number is Midland 5383.

Metal Finishing

A joint meeting of the London branch of the **Institute of Metal Finishing** and the **Organic Finishing Group** is to be held on Monday, February 17 next, at the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1, at 6.30 p.m. At this meeting a Paper will be presented by Dr. A. R. Thompson, M.D., entitled "Health Hazards Associated with Metals Affecting the Finisher."

British Foundrymen

A plea for increased production of goods was made by Sir Robert Boothby, M.P., when he spoke at the annual dinner of the Sheffield and District Branch of the **Institute of British Foundrymen** last week. In the long run, he said, the answer to our economic problems must be in the greater production of goods.

The Master Cutler, Sir Frederick Pickworth, also spoke and urged foundrymen to study scientific developments closely whenever they affected foundry work. Among the other guests at this function were Mr. W. J. Taylor, Parliamentary Secretary to the Minister of Supply; Mr. F. Cousans, senior vice-president of the branch; the Lord Mayor of Sheffield; Mr. H. Blakiston, National President of the Institute, and Mr. D. J. Haggie, President of the Sheffield Chamber of Commerce.

European Common Market

With the implementation of the European Common Market, it is interesting to note that the Repertoire National Du Commerce Exterieur, the directory of French foreign trade, in its 1958 edition, just published, has devoted a great deal of space to this new market. A special section has been added to the publication which includes articles on West Germany, Belgium, Italy, Luxembourg and The Netherlands.

Classified by trades, as usual, the lists of leading export firms in French industry have been brought up to date in this publication and the subject index has been simplified so that products can be found rapidly. There are some 35,000 listings in the book and the articles are printed in four languages.

Purchasing Officers' Conference

Southport is the venue of the 1958 National Conference of the **Purchasing Officers' Association,** and advance details of this event have now been issued. The conference will be held in the Victoria Hall and Art Gallery from October 2 to 4, and during this period the association will also hold its ninth annual Minibition.

The Minibition will follow the pattern of previous years in enabling manufacturers to bring, at a modest cost, the latest information regarding their products to the notice of buyers. Full details and reservation forms may be obtained from the secretary to the association at Wardrobe Court, 146a Queen Victoria Street, London, E.C.4.

An Acquisition

News from Scotland is to the effect that **James Galloway and Son,** of Dundee, have acquired the wire working business of Mr. John Thow, of Strathmartine Road, Dundee. This acquisition covers wire work, window guards, machinery guards, display work, and the like.

New Copper Association

Recent news from Ankara, Turkey, is to the effect that a number of owners of small copper processing plants in Turkey have formed an association, to be known as Copper Industry Company, which will have a capital of T£5 million. Shareholders plan to set up an electrolytic copper plant in the country, and anticipate that it will permit Turkey to save large amounts of foreign currencies, at present expended in payment for the processing of Turkish blister copper abroad.

Electronics Convention

Early notice is given of the 13th annual Electronics Exhibition and Convention, which is to be held at the Manchester College of Science and Technology during the periods July 10-12 and 14-16 inclusive this year. This event is organized by the Northern Division of the Institution of Electronics, and the exhibition will consist of a manufacturers' section and a scientific and industrial research section, including exhibits of interest to all branches of science and industry.

The convention will include a series of lectures and film shows on electronic topics. Admission will, as formerly, be free of charge. Full particulars may be obtained from the honorary exhibition organizer, Mr. W. Birtwistle, 78 Shaw Road, Rochdale, Lancs.

The "Zintec" Film

A twenty-minute film about the manufacture and application of "Zintec," the zinc-coated steel sheet, was previewed in London recently to an audience of about 100 industrialists. The film has been produced by **John Summers and Sons,** and will shortly be available on free loan from the company for industrial and educational screenings.

Lecture on Corrosion

A joint meeting of the Corrosion and Pesticides groups of the **Society of Chemical Industry** is to be held at 14 Belgrave Square, London, S.W.1, on Monday, February 17 next, when a lecture will be given on "Corrosion of Spraying and Dusting Machinery" by Mr. R. J. Courshee, B.Sc. The meeting will commence at 6 p.m.

Building Trades List

In the 1958 edition of **Sell's Building Trades List** over 40,000 names, addresses and telephone numbers are arranged alphabetically under 2,800 trade headings. Also listed are many who provide services relevant to the building trades. Three new sections have been introduced into this new edition; they are—contractors' plant, quarry products, and plastics. There is also a trade marks and brands section, while other pages contain details of over 600 organizations connected with the industry. The book contains 700 pages and the published price is 30s.

Annual Conference

Advance notice has been given of the annual conference of the **Coil Spring Federation Research Organisation,** which this year is to be held at the Imperial Hotel, Torquay, from Thursday, June 5, to Sunday, June 8. The business meetings will be held on the morning of June 6 and a technical session on the morning of June 7. Other social activities are to be arranged for the week-end.

Corrosion Resistance

A useful leaflet has been distributed by **The Pyrene Company Limited,** Metal Finishing Division, drawing attention to Parcolene No. 1, which is formulated for use as a final rinse, either by spray or immersion, to increase the corrosion resistance of Bonderized and Parkerized surfaces. The makers state that this solution meets the requirements of Defence Specification DEF-29 for the preparation of a "chromic" rinse.

Reference Book

A new edition of their "Specifications for Aluminium and Aluminium Alloy Products" has just been produced by **Northern Aluminium Company Limited.** Covering 108 pages, this reference book gives in tabular style a summary of all the official British specifications for aluminium alloys in semi-fabricated forms, together with the proprietary names of the alloys that are offered by British manufacturers to meet these specifications.

Principally of value to buyers, designers and others concerned with the specifications for aluminium alloys, the book is available freely on application to the company.

Nickel Deposits Found

Findings of nickel deposits that may well prove to be the largest yet uncovered in the United States have been reported by the Nickel Corporation of America. Pitting operations in Josephine County, Oregon, have established an indicated ore content of about 8 million tons in one of three areas being worked, with a grade of 1·1 per cent nickel or better, the company said. The estimate—by Simar, Knight and Associates, Toronto mining consultants—was on ore taken to a depth of 35 ft. on the Eight Dollar Mountain deposit. Potentially valuable ores in this and two other deposits were placed at 35·6 million tons for a 35 ft. depth.

Electrical Exhibits

Organized for the Association of Supervising Electrical Engineers by Electrical Engineers (A.S.E.E.) Exhibition Ltd., the Electrical Engineers' Exhibition will be held at Earls Court, London, from Tuesday to Saturday, March 25 to 29 next. Among the exhibits which will be presented are those by the following companies:—

Thomas Bolton and Sons Ltd.; British

Insulated Callender's Cables Ltd.; British Thomson-Houston Co. Ltd.; W. Canning and Co. Ltd.; Copper Development Association; Elliott Brothers (London) Ltd.; English Electric Co. Ltd.; Evershed and Vignoles Ltd.; Expanded Metal Co. Ltd.; General Electric Co. Ltd.; G.W.B. Furnaces Ltd.; Heenan and Froude Ltd.; Honeywell-Brown Limited; Imperial Chemical Industries Limited (Metals Division); Johnson, Matthey and Co. Ltd.; London Electric Wire and Smiths Limited; Mallory Metallurgical Products Ltd.; Metropolitan-Vickers Electrical Co. Ltd.; Monsanto Chemicals Ltd.; Partridge Wilson and Co. Ltd.; Philips Electrical Ltd.; Suffolk Iron Foundry (1920) Ltd.; Telcon Metals Group; Vactite Wire Co. Ltd.; Westinghouse Brake and Signal Co. Ltd., and Yorkshire Imperial Metals Ltd.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week totalled 15,508 tons, comprising London 5,235; Liverpool 9,443, and Hull 830 tons. Copper stocks totalled 19,755 tons and comprised London 11,272; Liverpool 6,608; Birmingham 1,175; Manchester 25; Swansea 425, and Hull 250 tons.

Minerals in Siberia

From Moscow it is reported that in an article on mineral deposits in Siberia which warrant exploitation, the Industrial and Economic Gazette states that wolfram, lead and zinc has been discovered in Yakutia. In the Far-Eastern districts of Khabarovsk and in the region adjoining the Pacific coast, tin has been found, in addition to lead, zinc and boron. In the Lake Baikal region, geologists have traced deposits of gold, tin, lead, zinc, wolfram, molybdenum and bauxite. At Norilsk, in the Krasnoyarsk area, the largest copper-nickel ore deposits of the Soviet Union have been found.

Turkish Chrome for U.S.A.

It is reported in Istanbul that Turkey has agreed to supply 150,000 metric tons of chrome ore, worth about five million dollars, to the United States. It is understood that deliveries will be made in large blocks spread over several months.

Rhodesian Production

Production of electrolytic copper in Northern Rhodesia dropped from 25,334 tons, worth £4,823,660, in October, to 22,525 tons, worth £4,243,293, in November, according to the Northern Rhodesia Department of Mines. The value of all minerals produced in November was £7,591,940, compared with £8,275,299 in October, and brought the total value for the year to £89,123,000, compared with £118,511,697 up to November, 1956. Production of manganese ore in Northern Rhodesia dropped from 3,681 tons, worth £45,951, in October, to 3,493 tons, worth £44,655, in November.

Mining in Cyprus

A statement issued by the Inspector of Mines in Nicosia says that the quantity of mineral products exported during 1957 was slightly higher than in 1956 (1,197,190 tons compared with 1,168,558 tons). The main items exported, together with their estimated values, were: 139,192 tons cupreous concentrates, valued at £4,365,400; 762,500 tons iron pyrites, valued at £3,491,460; 226,334 tons cupreous pyrites, valued at £1,833,525; 11,884 tons asbestos, valued at £717,711; 3,900 tons cement copper, valued at £501,000; 5,070 tons chromite, valued at £65,912; 4,705 tons terra umbra and ochre, valued at £57,791.

A Chairman's Statement

Speaking at the annual general meeting of **The David Brown Corporation Ltd**, at Huddersfield on Monday last, the chairman, Mr. David Brown, referred to the satisfactory position of the company. The Gear and Foundry Divisions had worked throughout the year at a high level of productivity, and have before them adequate work to keep them fully employed during the current year. The Automobile Division had practically the whole of their output accepted by their distributors for the next 12 months. The Machine Tool and Small Tool units had again been successful in obtaining orders for large machines in the face of American and German competition, and so far as the overseas subsidiaries of the company were concerned, the South African manufacturing company had made steady progress during the year, with an increased output of some 20 per cent, and the Canadian company had operated at a profit. With regard to prospects for the current year, the chairman said that the earnings in the first five months of this financial year had been substantially higher than those of the comparable period in the previous year, and every effort would be made to maintain this position.

A Works Visit

It has been announced by the Midland branch of the Institute of Metal Finishing that their April meeting (April 1) will be a joint meeting with the Automobile Division of the Coventry Centre of the Institution of Mechanical Engineers. This meeting will be held at the Leofric Hotel, Coventry, at 6.30 p.m., when a Paper will be presented by Mr. A. W. Wallbank.

The evening meeting will be preceded by a visit to the Motor Industry Research Testing Station at Lindley. Full details of this programme are available from Mr. I. T. Watkins, hon. secretary of the Midland Branch of the Institute, at Westalite House, Bradford Street, Birmingham, 5.

Non-Ferrous Welding

On Thursday of next week (February 13), a meeting of the Merseyside and North Wales branch of the **Incorporated Plant Engineers** will be held at the Exchange Hotel, Liverpool, commencing at 7.15 p.m. At this meeting, Mr. E. A. Foreman, of the British Oxygen Company Limited, will present a Paper on "Non-Ferrous Welding."

Instrumentation

A meeting of the Birmingham area members of the **Society of Instrument Technology** will be held on Friday next (February 14) at Regent House, St. Philip's Place, Birmingham, at 7 p.m., when an address will be given by Mr. G. H. Perks on "The Instrumentation of Small Steam-Raising Plant."

Trade and Merchandise Marks

Federal legislation affecting patents, trade marks and merchandise marks has now been passed in the Federation of Rhodesia and Nyasaland. Copies of the Patents Act, Trade Marks Act and Merchandise Marks Act and, in the case of the Patents Act and the Trade Marks Act, the regulations appertaining thereto, are available for inspection at the Export Services Branch, Board of Trade, Lacon House, Theobalds Road, London, W.C.1.

The Patents Act and the Trade Marks Act will come into operation on April 1, 1958; it is understood that the Merchandise Marks Act will come into operation some time in March, 1958.

Range of Electrodes

Designed specially for removing surplus metal from ferrous and non-ferrous metals, a new range of electrodes has been introduced by **The English Electric Company Ltd**. These electrodes, known as "Groovees," can be used with ordinary A.C. or D.C. welding plant without additional equipment such as oxygen or air supplies. The makers state that these electrodes leave a clean, scale-free surface that requires no further preparation before re-welding. They contain a steel wire core, thus providing no opportunity of carbon pick-up.

For cutting grooves the electrode is held at an angle to the work surface, pointing in the direction of travel. After an arc is struck, the electrode is moved rapidly along the line to be gouged. The force of the arc cuts the groove and removes the molten metal, giving a clean, bright finish. For gouging-out defects in castings, a series of overlapping grooves are cut in alternate directions, making it possible to remove a defect of considerable depth.

When piercing holes or removing rivets, the electrode is held perpendicular to the workpiece, the arc struck and held until the metal flows, and then the electrode moved into the molten pool. With manipulation, holes up to $\frac{1}{4}$ in. diameter can be pierced in plate up to $\frac{1}{2}$ in. thick, and rivets removed from much thicker plate. "Groovees" are supplied in two standard sizes, 10 S.W.G. and 8 S.W.G.

Materials Handling

A new type of battery electric tractor has recently been produced by Lansing Bagnall Ltd. for use in factories and warehouses. This latest model, known as the "Toer," is based on its diesel engined counterpart (the "Todr") and is, in fact, built on the same chassis. There seems to be a growing trend towards battery electric power and this new unit carries a 12 cell (24 volt) lead acid battery of 627 amp / hr. (15 kWH capacity. The tractor incorporates a built-in charger, so that at the end of the shift all that is required is that the tractor be driven up to some convenient mains point, to which it is plugged in. The charger design is such that the requisite charging characteristics of the battery are rigidly observed, and when the battery reaches full charge the supply is automatically terminated.

Tractive effort is provided by a compound wound heavy duty motor of 9 h.p. Considering the frequently exceptional braking requirements with which the tractor must contend, the company has built into this new model the Lansing Bagnall regenerative / rheostatic braking system. Upon decelerating, or braking, or descending an incline, the features of this system cause the drive motor to act as a generator, and whilst controlling speed it also regenerates power back to the battery. At lower speeds, rheostatic braking controls speed down almost to a standstill. These features, it is said,

minimize the need to operate the mechanical brake which is available for emergency stops.

Zinc Disposals

In accordance with their announcement of August 2, 1957, and subsequent announcements, the Board of Trade have been selling zinc from the stockpile at the rate of about 3,000 tons a month. They have now decided that in view of the state of the zinc market no further zinc will be offered for sale for the time being. An announcement will be made when it is decided to resume sales.

Work Study Techniques

With the advent of a European Free Trade Area, a number of industrial organizations in Britain are examining the possibility of reducing prices by making more effective use of the materials, capital and labour at their disposal. In order that these firms can benefit from modern work study techniques, the British Productivity Council has been making available a film called "The Whole Works."

The film shows how a large engineering firm, employing about 4,000 people, embarked on a complete reorganization scheme to secure higher efficiency in cost, production, development and quality control. It was made at the Edmonton factories of British Oxygen Engineering Limited and British Oxygen Gases Limited (Equipment Division).

According to the Council's Policy and Progress Report for 1956-57, the film was shown 179 times during the six months' period ending March, 1957. As well as being loaned to industrial organizations for private showing, it was also shown at work study exhibitions and at the Harrogate Festival of "Films in the Service of Industry." It has been distributed by local productivity associations and committees.

In continuance of the reorganization policy carried out at the British Oxygen factories, managers and engineers employed by the company are now piloting advanced developments in manufacturing and distribution in their own works. In addition, they have taken a leading part in major manufacturing and control developments which should prove of substantial advantage in such industries as shipbuilding and engineering construction.

The latest techniques of operational research and engineering development, and applications of the latest developments in data processing and automatic production control, are contained in the present projects. It is hoped that they will also provide case histories which will be of benefit to British industry generally.

Yugoslav Zinc

Yugoslav zinc producers have proposed to stop exports of zinc concentrates in view of the declining prices on world markets, it is reported here. Exports are uneconomic at present and it is advisable to send production to stockpile until prices improve, they say. However, credit will have to be forthcoming from the authorities before any stockpiling can be undertaken.

Mining in Eire

When the Eire Parliament meets next week, it will be asked to approve the Government's guarantee of borrowing by the Saint Patrick Copper Mines Limited, of Avoca, County Wicklow, to the extent of £1,368,420. The Government has decided to guarantee the company's borrowing and an order to this effect has been made under the State Guarantees Act, 1954.

Saint Patrick is a subsidiary of the Mobile Mining Corporation of Toronto, and was formed over two years ago to develop the copper mines in Avoca, which had already been explored by an Eire Government company at a cost of more than £500,000. The Irish subsidiary was formed with a capital of £2,000,000 which was underwritten by the parent body. The new company also undertook to repay £500,000 to the Eire Government for the cost of the previous exploration work, which revealed the presence of 12 million tons of copper ore in Avoca.

In the past two years the company has continued development work, and two cargoes of raw ore have been shipped to the Continent for smelting. These were stated to be sample cargoes. Work is also going on to construct a concentrator and this is expected to be ready in the summer. Meanwhile, active mining has produced about 100,000 tons of raw ore, which is now awaiting treatment at the concentrator. In the autumn the concentrates will be shipped through Arklow to the Continent for smelting.

An official of the company said that production was going ahead at the mine, which now employs 450, and there was no question of reducing output. The company would not be affected by the decision of the world's major copper producers to step down output this year by ten per cent, due to the continuing fall in copper prices.

Views on Copper

Speaking at an informal meeting of United States shareholders, in New York on Monday last, **Sir Ronald Prain,** chairman of the Rhodesian Selection Trust group, said yesterday: "The short-term outlook for copper has seldom been more confused, and I think it would be rashness indeed to presume to guess what may happen to the price of copper in the immediate future." Sir Ronald added: "It is, in my opinion, necessary to maintain a clear distinction between the short view and the long view. On the short view, it is clear that we are going through a period of over-production. This statistical position can be balanced by one or both of two happenings, namely, either a curtailment of production or an increase in consumption. In the meantime, and until the statistical position is redressed by one of these events, or both, we and others in the copper industry must expect leaner times than anything we have experienced for some years."

Sir Ronald noted that in times like the present, every opportunity should be taken to stimulate the consumption of copper and to find new uses for the metal. He said it had been suggested that the copper industry as a whole did not pay sufficient attention to this need. "While it cannot be disputed that the copper industry has much to learn in the way of promotion from some of the newer industries, which may be considered competitors," he said, "it would be a mistake, nevertheless, to assume that the copper industry is totally inactive in this respect." He pointed out that in many of the more industrialized countries there existed agencies concerned exclusively with the development of copper both by research and by publicity.

"In this country you have the Copper and Brass Research Association, and in the U.K. they have the Copper Development Association, which exist for the purpose of helping consumers, and generally of publicizing the use of copper. Many countries in Europe have recently set up similar though smaller organizations, and others are in the process of being formed.

"Turning now from the general outlook to the particular position of our mines, I can sum up the developments quickly as follows: At Mufulira we are proceeding with the Mufulira West development. As far as Roan Antelope is concerned, I would draw your attention to the ore reserve figures which include, for the first time, any substantial tonnages from the Muliashi concession; and to the continued progress being made in the construction of the electrolytic refinery at Ndola. It is expected that the first stage of this refinery will become operative in the current year.

"In the case of Chibuluma, we have begun to repay our loan to the U.S. Government. I would again like to underline the point that we have made from time to time, namely, that Chibuluma's rate of metal production in the last six months of last year was abnormal. This arose from working off concentrate stocks which would not be smelted in the financial year ended last June. This stockpile will have been reduced to normal during the past quarter, and the smelting rate thereafter should approximate more closely to the mining rate."

Projecting Loads

New provisions will come into operation on October 1 for the rear lighting of loads projecting behind or from the sides of road vehicles. Any extra rear light must be carried during darkness, not more than 3½ ft. from the extreme rear of any load which projects more than that distance behind the normal rear lights. In the case of vehicles carrying fire escapes, and of land or agricultural tractors on which agricultural implements are mounted, 6 ft. will be substituted for 3½ ft. The regulations also require an extra rear light not more than 12 in. from the outer edge of any load which projects more than that distance beyond the side of a vehicle or trailer.

Forthcoming Meetings

February 10 — East Midlands Metallurgical Society. Nottingham and District Technical College, Shakespeare Street, Nottingham. Members' Night—Short Papers presented by Members. 7.30 p.m.

February 10—Institute of Metals. Scottish Local Section. Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2. "Recent Developments in the Foundry." D. V. Atterton. 6.30 p.m.

February 11 — Institution of Production Engineers. Birmingham Graduate Section. The James Watt Memorial Institute, Great Charles Street, Birmingham. "Metal Spraying." W. E. Stantion. 7 p.m.

February 12 — Manchester Metallurgical Society. Manchester Room, The Central Library, Manchester. "Plastics versus Metals." J. M. J. Estevez. 6.30 p.m.

February 13 — Incorporated Plant Engineers. Merseyside and North Wales Branch. The Exchange Hotel, Liverpool. "Non-Ferrous Welding." E. A. Foreman. 7.15 p.m.

Metal Market News

LAST week proved to be a better week than its predecessor so far as the holders of metal were concerned, for gains were registered all along the line, even though in some instances the close was below the best. A better tone, too, prevailed on the stock markets both in New York and London so that, one way and another, sentiment was more optimistic than for some time past. Copper at one time was bid up to £168 for cash and £169 three months, probably on the strength of rumours that shipments of metal might be moving from this side to the United States, in consequence of which stocks here would be reduced. Actually, at the beginning of the week there was an increase of 151 tons in the L.M.E. warehouse tonnage to 20,055 tons. Friday saw quite a sharp setback and a widening of the contango, which had narrowed to 10s. At the close of the afternoon market, cash stood at £163 15s. 0d. and three months at £165 5s. 0d., these quotations registering gains of £2 15s. 0d. and £2 for the respective positions. The turnover was about 10,000 tons. Early in the week a cut of 10 per cent in production was announced by Anglo American Corporation in respect of their Rhodesian copper mines, together with total suspension of activities at the Bancroft mine for this year. The announcement was received very coolly by the market, and what rally there was proved to be shortlived.

For some time past there have been reports that the publication of a special price was in the offing, and last Friday brought details of this scheme. In short, nine producers have arranged to report their sales of electro daily to a trade journal, which will publish a daily weighted average quotation based on these details, and also a weekly arithmetical price. The basis of quotation will be c.i.f. main European ports or equivalent, and the whole plan would appear to be conceived on lines similar to those of the E. and M.J. price. It is as yet too early to report on the reactions to this plan, but initially opinion seems to be that this valuation will be merely a reflection of the L.M.E. settlement quotation, although probably ruling slightly above it, and that, in consequence, it cannot be of much use to the trade. Where the R.S.T. special quotation failed it hardly seems likely that this new idea will succeed, but we shall know more about its influence after a few months have gone by. The producers concerned in this new venture are Anaconda, Kennecott, American Metal Co., International Nickel, Hudson Bay and Noranda in the American continent, and Rhodesian Selection Trust, Anglo-American and Katanga in Africa.

In tin last week there was a turnover of some 2,175 tons, with a gain of £1 in cash and of £10 10s. 0d. in three months. Two points emerge, viz. the premium in the cash price over the official support level of £730 and the virtual elimination of a backwardation, for the closing quotations were £734 cash and £733 10s. 0d. three months. The improvement in the Eastern quotation seems to have been responsible for starting the rally in London, and it now looks as if the Tin Council were over its immediate anxieties. Stocks of tin in the U.K. in L.M.E. warehouses increased by 725 tons to 15,520 tons. Lead improved by £1 for the current month while April was up by 15s. In zinc there was a rise of 30s. prompt and £1 forward, the close being £64 5s. 0d. and £63 5s. 0d. The vexed question of the revised duties on lead and zinc still hangs fire, but both these metals, especially zinc perhaps, have taken on something approaching a "new look" and the turnovers last week were pretty good. Business with consumers, however, is said to be only moderate.

Birmingham

Output in the industrial Midlands is high. This is due in large measure to the prosperity of the motor industry, on which so many others depend in this district. The recent trade improvement in the machine tool industry covers both home and export business, but manufacturers take the view that solid expansion is likely to be delayed until there is some easing of the Bank Rate. One of the bright spots is the electrical engineering trade. Full work is assured for a fair way ahead at the factories engaged on production of equipment for power stations in this country and abroad, and further contracts have been placed by British Railways in connection with the electrification of some of the main lines. The building trade is dull.

An active demand continues for castings for the engineering industries, but conditions are quiet in the foundries making builders' and domestic hardware. Makers of heavy structural steel are delivering substantial tonnages of joists, sections, girders and angles to building sites, but pressure for supplies is not so heavy as it was a year ago. Demand for heavy steel plates exceeds the supply, and the shortage seems likely to continue until new plant is brought into operation. Meanwhile, some users are buying from America and from some of the European countries. Re-rollers could handle more work than they have on hand at the moment and stocks of billets are more than sufficient for the demand.

New York

Copper prices are still precarious, despite recent cuts in both quotations and production. Producers reported only small sales at the 25 cent level over the past week and said deliveries were running under the same time last year. Custom smelter copper witnessed only limited fill-in business at 24 cents a lb. During the latter part of the period under review there was considerable confusion in domestic copper circles as to what effect the Chile - Kennecott agreement would have. Domestic consumers for the most part preferred to remain on the sidelines and await further developments. While they were impressed by the firmer tone in London on Monday, the price there was still below the domestic level, it was pointed out.

In scrap copper, custom smelters trimmed their buying price for No. 2 copper wire by half-a-cent to 17·50 cents a lb. The higher London market towards the end of the period had no effect on this price, and demand continued slow.

The industry reports demand for copper has remained slow. Brass mills foresee no improvement in demand for their products in the immediate future, with some sources not anticipating any important pick-up until the fourth quarter. However, their customers' inventories are believed to have been cut to the bone, and brass mills estimate such reductions in users' stocks are about over. "From now on," one mill official says, "mill shipments should represent close to what may be considered actual consumption of the metal." Brass mill executives agree that January business has not been good. It is a little better than in December, but volume last month represented the low point in a long while, one official reported.

Demand for lead and zinc was slightly better during the period under review, but interest in lead was still considered unsatisfactory and the zinc market was described as dull. A cut in zinc output was disclosed last week by American Metal Climax, Incorporated, who said it was trimming production by 2,000 tons a month at its Blackwell, Oklahoma, smelter.

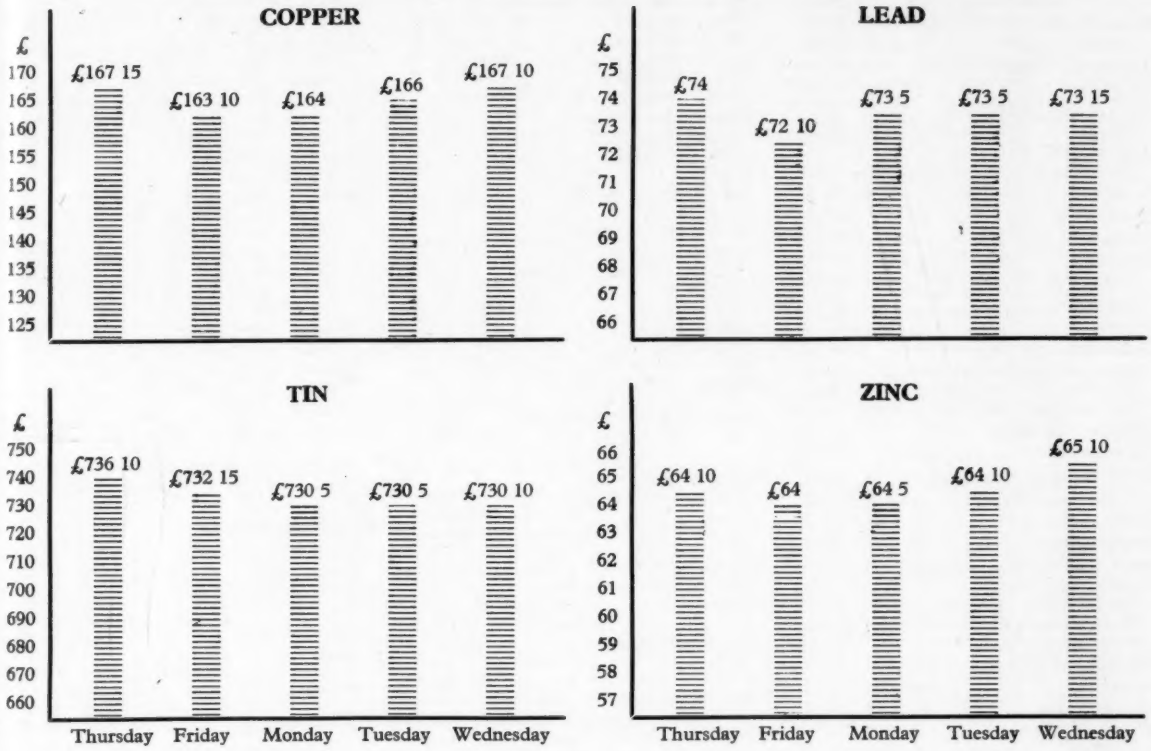
Tin prices moved upwards during most of the period under review, helped by the agreement reached last week by the International Tin Council. However, the improvement did not last long. On Monday there were more sellers than buyers in the domestic market and prices slipped.

Paris

The downward move of non-ferrous scrap prices continued this week on the Paris market. Selling pressure was still heavy, reflecting discouraging foreign advices, while buyers were reserved. Traders said the decline would probably continue unless a sharp reversal of the price trends in foreign centres was noted.

METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 30 January 1958 to Wednesday 5 February 1958



OVERSEAS PRICES

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏ £/ton	Canada c/lb ≏ £/ton	France fr/kg ≏ £/ton	Italy lire/kg ≏ £/ton	Switzerland fr/kg ≏ £/ton	United States c/lb ≏ £/ton
Aluminium		24.63 203 10	210 182 15	400 232 0	2.50 209 0	28.10 224 17 6
Antimony 99.0			195 169 12 6	430 249 10		33.00 264 0
Cadmium			1,400 1,218 0	2,800 1,624 0		155.00 1,240 0
Copper						
Crude						
Wire bars 99.9				345 200 8 6		
Electrolytic	23.75 173 12 6	24.75 202 10	223 194 0		2.20 184 0	25.00 200 0
Lead		12.25 101 2 6	123 107 0	181 105 0	.92 77 0	13.00 104 0
Magnesium						
Nickel		71.50 590 10	1,205 104 17 6	1,330 771 10	8.10 677 2 6	74.00 592 0
Tin	100.50 734 12 6		880 765 12 6	1,400 812 0	8.80 735 17 6	93.50 748 0
Zinc						
Prime western		10.00 82 12 6				10.00 80 0
High grade 99.95		10.60 87 10 0				
High grade 99.99		11.00 90 5				
Thermic			107.12 93 2 6			
Electrolytic			115.12 100 2 6	158 91 12 6	.85 71 0	11.75 94 0

NON-FERROUS METAL PRICES

(All prices quoted are those available at 12 noon 5/2/58)

PRIMARY METALS

		£	s.	d.
Aluminium Ingots	ton	197	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		10	0
Calcium	„	2	0	0
Cerium 99%	„	13	18	0
Chromium	„		6	11
Cobalt	„		16	0
Columbite	per unit		—	
Copper H.C. Electro	ton	167	10	0
Fire Refined 99·70%	„	166	0	0
Fire Refined 99·50%	„	165	0	0
Copper Sulphate	„	67	0	0
Germanium	grm.		3	4
Gold	oz.	12	9	0½
Indium	„		10	0
Iridium	„	27	0	0
Lanthanum	grm.		15	0
Lead English	ton	73	15	0
Magnesium Ingots	lb.		2	5½
Notched Bar	„		2	10½
Powder Grade 4	„		6	3
Alloy Ingot, A8 or AZ91	„		2	8
Manganese Metal	ton	300	0	0
Mercury	flask	73	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	
Palladium	„		7 10	0
Platinum	„	28	10	0
Rhodium	„	40	0	0
Ruthenium	„	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	4½
Tellurium	lb.		15	0
Tin	ton	730	10	0
Titanium	lb.		19	6
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	64	13	9
Dust 95/97%	„	104	0	0
Dust 98/99%	„	110	0	0
Granulated 99+%	„	89	13	9
Granulated 99·99+%	„	106	5	0

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	231	0	0
B.S. 1490 L.M.6 „	221	0	0
B.S. 1490 L.M.7 „	233	0	0
B.S. 1490 L.M.8 „	222	0	0
B.S. 1490 L.M.9 „	221	0	0
B.S. 1490 L.M.10 „	238	0	0
B.S. 1490 L.M.11 „	235	0	0
B.S. 1490 L.M.12 „	245	0	0
B.S. 1490 L.M.13 „	233	0	0
B.S. 1490 L.M.14 „	246	0	0
B.S. 1490 L.M.15 „	230	0	0
B.S. 1490 L.M.16 „	225	0	0
B.S. 1490 L.M.18 „	222	0	0
B.S. 1490 L.M.22 „	233	0	0

	£	s.	d.
†**Aluminium Alloy (Secondary)**			
B.S. 1490 L.M.1 ton	154	10	0
B.S. 1490 L.M.2 „	158	10	0
B.S. 1490 L.M.4 „	182	0	0
B.S. 1490 L.M.6 „	204	10	0
†Average selling prices for November.			
***Aluminium Bronze**			
BSS 1400 AB.1 ton		—	
BSS 1400 AB.2 „		—	
***Brass**			
BSS 1400-B3 65/35 „	128	0	0
BSS 249 „		—	
BSS 1400-B6 85/15 „		—	
***Gunmetal**			
R.C.H. 3/4% ton ton		—	
(85/5/5/5) „	157	0	0
(86/7/5/2) „	167	0	0
(88/10/2/1) „	210	0	0
(88/10/2/½) „	219	0	0
Manganese Bronze			
BSS 1400 HTB1 „	173	0	0
BSS 1400 HTB2 „		—	
BSS 1400 HTB3 „	192	0	0
Nickel Silver			
Casting Quality 12% „		nom.	
„ „ 16% „		nom.	
„ „ 18% „		nom.	
***Phosphor Bronze**			
2B8 guaranteed A.I.D. released „	235	0	0
Phosphor Copper			
10% „	202	0	0
15% „	210	0	0
**Average prices for the last week-end.*			
Phosphor Tin			
5% ton		—	
Silicon Bronze			
BSS 1400-SB1 „		—	
Solder, soft, BSS 219			
Grade C Tinmans „	345	6	0
Grade D Plumbers „	279	9	0
Grade M „	378	6	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „ „		—	
Zinc Alloys			
Mazak III ton	99	10	0
Mazak V „	103	10	0
Kayem „	109	10	0
Kayem II „	115	10	0
Sodium-Zinc lb.		2	5½

SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium	£	s.	d.
Sheet 10 S.W.G. lb.		2	9
Sheet 18 S.W.G. „		2	11
Sheet 24 S.W.G. „		3	2
Strip 10 S.W.G. „		2	9
Strip 18 S.W.G. „		2	10
Strip 24 S.W.G. „		2	11½
Circles 22 S.W.G. „		3	3
Circles 18 S.W.G. „		3	2
Circles 12 S.W.G. „		3	1
Plate as rolled „		2	8½
Sections „		3	2½
Wire 10 S.W.G. „		3	0
Tubes 1 in. o.d. 16 S.W.G. „		4	1

Aluminium Alloys	£	s.	d.
BS1470. HS10W. lb.			
Sheet 10 S.W.G. „		3	1½
Sheet 18 S.W.G. „		3	4
Sheet 24 S.W.G. „		3	11½
Strip 10 S.W.G. „		3	1½
Strip 18 S.W.G. „		3	3
Strip 24 S.W.G. „		3	11
BS1477 HP30M.			
Plate as rolled		2	11½
BS1470. HC15WP.			
Sheet 10 S.W.G. lb.		3	9½
Sheet 18 S.W.G. „		4	1½
Sheet 24 S.W.G. „		4	11½
Strip 10 S.W.G. „		3	10½
Strip 18 S.W.G. „		4	1½
Strip 24 S.W.G. „		4	9
BS1477. HPC15WP.			
Plate heat treated „		3	6½
BS1475. HG10W.			
Wire 10 S.W.G. „		3	10½
BS1471. HT10WP			
Tubes 1 in. o.d. 16 S.W.G. „		5	0
BS1476. HE10WP.			
Sections „		3	2
Beryllium Copper			
Strip „	1	4	11
Rod „	1	1	6
Wire „	1	4	9
Brass Tubes „		1	4½
Brazed Tubes „		—	
Drawn Strip Sections „		—	
Sheet ton		—	
Strip „	202	15	0
Extruded Bar lb.		1	7⅝
Extruded Bar (Pure Metal Basis) „		—	
Condenser Plate (Yellow Metal) ton	141	0	0
Condenser Plate (Naval Brass) „	151	0	0
Wire lb.		2	2½
Bronze Sheet and Strip ton		—	
Copper Tubes lb.		1	7⅝
Sheet ton	191	10	0
Strip „	191	10	0
Plain Plates „		—	
Locomotive Rods „		—	
H.C. Wire „	212	15	0
Cupro Nickel			
Tubes 70/30 lb.		3	1½
Lead Pipes (London) ton	112	5	0
Sheets (London) „	110	0	0
Tellurium Lead „	£6 extra		
Nickel Silver			
Rods lb.		—	
Sheet and Strip 7% „		3	2
Wire 10% „		3	8½
Phosphor Bronze			
Wire „		3	5
Titanium			
Billet lb.	4	10	0
Sheet „	6	12	0
Wire „	9	10	0
Tube „	16	0	0
Zinc Sheets, English destinations ton	98	0	0
Strip „	nom.		

Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 4/2/58.

	£
Aluminium	
New Cuttings	160
Old Rolled	130
Segregated Turnings	97
Brass	
Cuttings	114
Rod Ends	106
Heavy Yellow	88
Light	83
Rolled	104
Collected Scrap	84
Turnings	101
Copper	
Wire	140
Firebox, cut up	140
Heavy	134
Light	129
Cuttings	140
Turnings	123
Braziery	114
Gunmetal	
Gear Wheels	145
Admiralty	145
Commercial	118
Turnings	113
Lead	
Scrap	64
Nickel	
Cuttings	—
Anodes	530
Phosphor Bronze	
Scrap	118
Turnings	113
Zinc	
Remelted	52
Cuttings	43
Old Zinc	30

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£148.0.6)	170
Heavy copper	(£148.0.0)	170
Light copper	(£121.17.6)	140
Heavy brass	(£95.15.0)	110
Light brass	(£65.5.0)	75
Soft lead scrap	(£52.5.0)	60
Zinc scrap	(£34.17.6)	40
Used aluminium unsorted	(£82.12.6)	95
France (francs per kilo):		
Copper	(£187.0.0)	215
Heavy copper	(£187.0.0)	215
Light brass	(£134.17.6)	155
Zinc castings	(£67.0.0)	77
Tin	(£565.10.0)	650
Aluminium pans (98½ per cent)	(£139.5.0)	160
Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£194.7.6)	335
Aluminium copper alloy	(£104.10.0)	180
Lead, soft, first quality	(£88.15.0)	153
Lead, battery plates	(£53.7.6)	92
Copper, first grade	(£162.10.0)	280
Copper, second grade	(£148.0.0)	255
Bronze, first quality machinery	(£168.5.0)	290
Bronze, commercial gunmetal	(£139.5.9)	240
Brass, heavy	(£110.5.0)	190
Brass, light	(£101.10.0)	175
Brass, bar turnings	(£116.0.0)	200
New zinc sheet clippings	(£58.0.0)	100
Old zinc	(£43.10.0)	75

Financial News

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons, Limited, Company Registration Agents, Chancery Lane, W.C.2.

Ellison Metal Products Ltd. (595152), The Old Brewery, Duffield Road, Little Eaton, Derby. Registered December 10, 1957. To carry on business of general engineers and assemblers, manufacturers of and dealers in optical instruments, etc. Nominal capital, £1,050 in £1 shares (50 pref.). Directors: H. Elliott and Mrs. E. M. Elliott.

Aluminium Mechanical Development Co. Limited (595290), 199 Piccadilly, W.1. Registered December 13, 1957. Nominal capital, £1,000 in £1 shares. Permanent directors: A. C. Harper and J. R. Cable.

Frank A. Briggs Limited (595325), Vulcan Works, Birds Royd, Brighouse, Yorks. Registered December 13, 1957. To take over the business of a sheet metal worker carried on as "Frank A. Briggs" at Brighouse by H. Mark, etc. Nominal capital, £5,000 in £1 shares. Directors: H. Mark, Norma Mark and Bessie Mark.

Metal and Plastic Products Company (Balsall Common) Limited (595333), 325 Kenilworth Road, Balsall Common, near Coventry. Registered December 13, 1957. Nominal capital, £1,000 in £1 shares. Directors: H. W. Brown and H. J. Field.

Coley Utilities Limited (595385), Jubilee Works, Chapel Road, Hounslow. Registered December 16, 1957. Carry on business of metal merchants, etc. Nominal capital, £10,000 in £1 shares. Directors not named. Subscribers: R. J. Coley and R. W. Coley.

Miles Druce Steel Limited (595508), Horn Lane, W.3. Registered December 17, 1957. To carry on business of machinery and metal merchants, etc. Nominal capital, £100 in £1 shares. Directors not named.

N. R. Purdy and Co. Ltd. (595512), 31 Windermere Road, Dewsbury. Registered December 17, 1957. To carry on business of scrap metal dealers, etc. Nominal capital, £1,000 in £1 shares. Permanent directors: W. Ewart and Mrs. L. Purdy.

Le Grand Western Foundries Limited (595538). Registered December 17, 1957. To take over all or any part of the business of Le Grand Sutcliffe and Gell Ltd., and to carry on business of founders, etc. Nominal capital, £10,000 in £1 shares, Directors to be appointed by subscribers.

Trade Publications

Commander KE Instruments.—George Kent Limited, Luton, Beds.

A new leaflet has just been issued by this company descriptive of their high-speed electronic instruments. The range of instruments is described in detail, together with a number of useful photographs.

Photographic Catalogue. — Kodak Ltd., Kodak House, Kingsway, London, W.C.2.

This 164-page professional catalogue contains details of the extensive range of materials and equipment for commercial, industrial and portrait photographs. It is divided into sections dealing with films, colour techniques, plates, papers, chemicals, cameras and camera accessories, still viewing equipment, light equipment, processing and workroom equipment, and document copying equipment. Also included are many photographs.

Incandescent-Laclede Tile Suspension.—The Incandescent Heat Company Ltd., Cornwall Road, Smethwick, Birmingham.

The Incandescent-Laclede suspended roof is stated to be specially suited to high-temperature furnaces where a heavy thickness of insulation is required. The suspension is simple and sturdy, being designed to avoid the troubles often associated with special shapes. Each tile is of convenient shape and size for easy handling by the erector. This coloured leaflet describes the components necessary for the assembly of this improved tile suspension, and some useful illustrations are also given.

Salts and Salt Baths.—Imperial Chemical Industries Limited, Imperial Chemical House, Millbank, London, S.W.1.

From the Billingham Division of I.C.I. comes this new booklet, which deals with salts and salt baths for the heat-treatment of aluminium and its alloys. The main purpose of the publication is to provide general information about the salts used and the behaviour of these salts in industrial salt baths. Detailed specifications of the heat-treatments involved are not discussed; this information is readily available from the manufacturers of the alloys and from other sources. The data which is included, however, will assist existing and intending users of salt baths in the problems directly associated with the melt.

Bogie Hearth Furnaces. — G.W.B. Furnaces Limited, P.O. Box No. 4, Dibdale Works, Dudley.

A useful leaflet is devoted to electrical resistance heated bogie hearth furnaces. This type of furnace is essentially a batch unit and many details are given of this unit. Some illustrations are also included. A wide variety of heat-treatments may be carried out in this type of furnace and the maximum temperature range is only limited by the limitations of the resistance elements, the maximum being around 1,200°C. With the application of automatic programme controllers, a fixed process cycle can be obtained and repeated to suit a specific charge.

THE STOCK EXCHANGE

Very Few Outstanding Changes And Business Still Rather Quiet

ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 4 FEBRUARY +RISE	—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1958 HIGH	1958 LOW	1957 HIGH	1957 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	19/6		10	10	10 5 3	19/9	19/1½	28/3	18/–
400,000	2/–	Anti-Attrition Metal	1/6		8½	7½	11 6 9	1/6	1/3	2/6	1/6
33,639,483	Stk. (£1)	Associated Electrical Industries ...	50/–	+2/–	15	15	6 0 0	50/–	47/6	72/3	47/9
1,590,000	1	Birfield Industries	52/6		15	20N	5 14 3	53/9	51/9	70/–	48/9
3,196,667	1	Birmid Industries	57/3		17½	17½	6 2 3	57/9	56/3	80/6	55/9
5,630,344	Stk. (£1)	Birmingham Small Arms	25/9		10	8	7 15 3	26/7½	25/9	33/–	21/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/–		5	5	6 13 3		—	16/–	15/–
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/6		6	6	7 5 6	17/–	16/6	19/–	16/6
500,000	1	Bolton (Thos.) & Sons	28/9		12½	12½	8 14 0		—	30/3	28/9
300,000	1	Ditto Pref. 5%	15/3		5	5	6 11 3		—	16/9	14/3
160,000	1	Booth (James) & Co. Cum. Pref. 7%	19/–		7	7	7 7 3		—	22/3	18/9
9,000,000	Stk. (£1)	British Aluminium Co.	44/9	+1/–	12	12	5 7 3	44/9	41/3	72/–	38/3
1,500,000	Stk. (£1)	Ditto Pref. 6%	19/3	+9d.	6	6	6 4 9	19/3	18/4½	21/6	18/–
15,000,000	Stk. (£1)	British Insulated Callender's Cables	42/–	+6d.	12½	12½	5 19 0	42/–	38/10½	55/–	40/–
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	29/6	+3d.	10	15N	6 15 6	32/3	29/1½	39/–	29/6
600,000	Stk. (5/–)	Canning (W.) & Co.	20/6		25	25	6 2 0	20/7½	20/1½	24/6	19/3
60,484	1/–	Carr (Chas.)	2/–	—3d.	25	25	12 10 0	2/3	2/–	3/6	2/1½
150,000	2/–	Case (Alfred) & Co. Ltd.	4/6		25	25	11 2 3	4/9	4/4	4/6	4/–
555,000	1	Clifford (Chas.) Ltd.	16/4½	+3d.	10	15N	12 4 3	16/6	16/4½	20/6	15/9
45,000	1	Ditto Cum. Pref. 6%	15/10½		6	6	7 11 3		—	17/6	16/–
250,000	2/–	Coley Metals	4/6	+1½d.	25	25	11 2 3	4/6	4/3	5/7½	3/9
8,730,596	1	Cons. Zinc Corp.†	47/9	+9d.	22½	22½	9 8 6	51/6	47/–	92/6	49/–
1,136,233	1	Davy & United	48/–	+6d.	15	12½	6 5 0	48/–	46/3	60/6	42/6
2,750,000	5/–	Delta Metal	20/7½	+4½d.	•17½	•17½	4 5 0	21/4½	19/9	28/6	19/–
4,160,000	Stk. (£1)	Enfield Rolling Mills Ltd.	26/6	+1/–	15B	22½	9 8 9	26/6	24/–	38/6	25/–
500,000	1	Evered & Co.	41/3	+3d.	15	15	7 5 6	41/3	41/–	52/9	42/–
18,000,000	Stk. (£1)	General Electric Co.	33/7½	—4/1½	12½	14	Y6 16 9	38/7½	33/7½	59/–	38/–
1,250,000	Stk. (10/–)	General Refractories Ltd.	27/6		17½	17½	6 7 3	28/3	27/3	37/–	26/9
401,240	1	Gibbons (Dudley) Ltd.	64/–		15	12	4 13 9	64/–	64/–	71/–	53/–
750,000	5/–	Glacier Metal Co. Ltd.	5/9		11½	11½	10 0 0	6/–	5/7½	8/1½	5/10½
1,750,000	5/–	Glynwed Tubes	13/–		20	20	7 13 9	13/1½	12/10½	18/–	12/6
3,614,032	10/–	Goodlass Wall & Lead Industries ...	29/–		18	16	6 4 3	29/9	28/10½	37/3	28/9
342,195	1	Greenwood & Batley	46/10½		17½	17½	7 9 3		—	50/–	46/–
396,000	5/–	Harrison (B'ham) Ord.	11/6		•15	•30‡	6 10 6		—	16/9	12/4½
150,000	1	Ditto Cum. Pref. 7%	18/9		7	7	7 9 3		—	22/3	18/7½
1,075,167	5/–	Heenan Group	7/4½	+1½d.	10	20‡	6 15 6	7/4½	6/9	10/4½	6/9
142,045,750	Stk. (£1)	Imperial Chemical Industries ...	39/10½	+1/7½	10	10	5 0 3	39/10½	37/6	46/6	36/3
33,708,769	Stk. (£1)	Ditto Cum. Pref. 5%	17/–		5	5	5 18 0	17/1½	16/–	18/6	15/6
14,584,025	**	International Nickel	144	+4	$3.75	$3.75	4 14 0	144	136½	222	130
430,000	5/–	Jenks (E. P.), Ltd.	15/3	—3d.	27½ ϕ	27½	9 0 6	15/7½	14/6	18/10½	15/1½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	15/–		5	5	6 13 3		—	17/–	14/6
3,987,435	1	Ditto Ord.	40/–	—6d.	10	9	5 0 0	41/3	39/6	58/9	40/–
600,000	10/–	Keith, Blackman	16/3		15	15	9 4 6	16/3	15/–	21/9	15/–
160,000	4/–	London Aluminium	4/1½	+1½d.	10	5	9 14 0	4/3	3/10½	6/9	3/6
2,400,000	1	London Elec. Wire & Smith's Ord....	41/3	+3d.	12½	12½	6 1 3	4/6	40/6	54/6	41/–
400,000	1	Ditto Pref.	22/9		7½	7½	6 11 9		—	25/3	21/9
765,012	1	McKechnie Brothers Ord.	35/–		15	15	8 11 6		—	48/9	37/6
1,530,024	1	Ditto A Ord.	32/6		15	15	9 4 6		—	47/6	36/–
1,108,268	5/–	Manganese Bronze & Brass	9/3		27½‡	25	7 8 9	9/6	9/–	21/10½	7/6
50,628	6/–	Ditto (7½% N.C. Pref.)	5/9		7½	7½	7 16 6		—	6/6	5/–
13,098,855	Stk. (£1)	Metal Box	43/9	+1/6	20‡	15M	4 11 6	43/9	41/9	59/–	40/3
415,760	Stk. (2/–)	Metal Traders	6/3	—3d.	50	50	16 0 0	6/6	6/3	8/–	6/3
160,000	1	Mint (The) Birmingham	22/9		10	10	8 15 9	22/9	22/9	25/–	21/6
80,000	5	Ditto Pref. 6%	83/6		6	6	7 3 9		—	90/6	83/6
3,064,930	Stk. (£1)	Morgan Crucible A	35/6		10	11	5 12 9	36/6	35/1½	54/–	35/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/3		5½	5½	6 7 6	17/3	17/–	19/3	16/–
2,200,000	Stk. (£1)	Murex	55/–	—3d.	20	20	7 5 6	57/6	54/10½	79/9	57/–
468,000	5/–	Ratcliffs (Great Bridge)	7/–	+1½d.	10	10	7 2 9	7/–	6/10½	8/–	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	26/6		27½D	27½	6 18 3	27/–	26/–	41/–	24/9
1,365,000	Stk. (5/–)	Serck Radiators	11/6	+3d.	17½Z	15	5 1 6	12/–	11/1½	18/10½	11/6
600,400	Stk. (£1)	Stone (J.) & Co. (Holdings)	43/9		16	16	7 6 6		—	57/6	43/9
600,000	1	Ditto Cum. Pref. 6½%	20/–		6½	6½	6 10 0		—	21/9	18/9
14,494,862	Stk. (£1)	Tube Investments Ord.	51/9	+7½d.	15	15	5 16 0	53/9	51/1½	70/9	50/6
41,000,000	Stk. (£1)	Vickers	30/3	+1½d.	10	10	6 12 3	31/–	29/4½	46/–	29/–
750,000	Stk. (£1)	Ditto Pref. 5%	15/–	—6d.	5	5	6 13 3	15/3	14/9	18/–	14/–
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	21/4½	—7½d.	•5	•5	7 4 3A	22/–	21/3	24/9	20/7½
2,200,000	1	Ward (Thos. W.), Ord.	73/6		20	15	5 8 9	73/6	70/9	83/–	64/–
2,666,034	Stk. (£1)	Westinghouse Brake	36/–	+2/7½	10	18P	5 11 0	36/–	32/6	85/–	29/1½
225,000	2/–	Wolverhampton Die-Casting ...	7/6		25	40	6 13 3	7/9	7/2½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	15/6		27½	27½	8 17 6	15/6	14/9	22/3	14/9
78,465	2/6	Wright, Bindley & Gell	3/7½		20	17½E	13 15 9	3/9½	3/7½	3/9	2/7½
124,140	1	Ditto Cum. Pref. 6%	11/6		6	6	10 8 9		—	12/6	11/3
150,000	1/–	Zinc Alloy Rust Proof	2/10½		40D	33½	9 5 6	3/–	2/7½	5/–	2/9

•Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% Capitalized issue. * The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. H and 200% capitalized issue. M and 10% capitalized issue. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. P and 100% capitalized issue, also "rights" issue of 2 new shares at 35/– per share or £3 stock held. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ϕ And proposed 100% capitalized issue.